CAREER PATHS

Electronics

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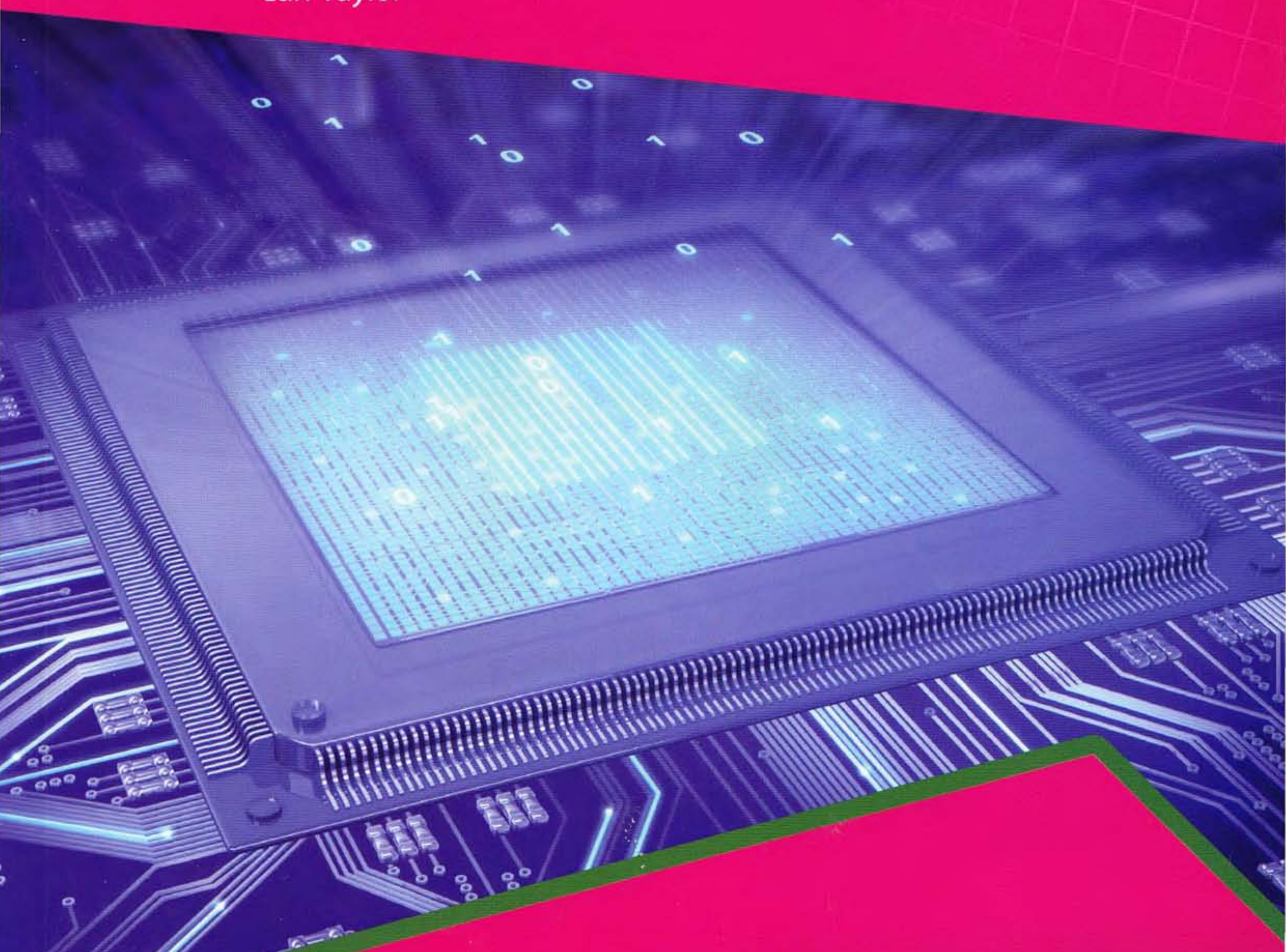

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Career Paths

Electronics

Book 1

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Scope and sequence

Unit	Topic	Reading context	Vocabulary	Function
1	Consumer electronics	Advertisement	consumer electronics, television, stereo, speaker, computer, cell phone, tablet, camcorder, digital camera, MP3 player, DVD player, e-book reader	Offering assistance
2	Electricity basics	Course description	electron, conduct, ampere, current, circuit, charge, volt, resistance, ohm, watt, electricity	Asking for clarification
3	Electricity basics 2	Textbook excerpt	direct current, negative, positive, polarity, alternating current, hertz, capacitance, inductance, transformer, reactance, impedance, rectification	Checking for understanding
4	Tools	Advice column	flathead screwdriver, Phillips screwdriver, hex wrench, torque wrench, diagonal cutters, needlenose pliers, hemostat, magnifier, hammer, wire stripper, electrical tape	Expressing preferences
5	Tools 2	Webpage	clip lead, alcohol, naphtha, heatsink grease, heat-shrink tubing, glue gun, magnet, bench vise, super glue, cooler spray, stereo microscope	Repeating information
6	Soldering tools	Instructions	soldering iron, tip, solder, remove, solder wick, solder sucker, vacuum pump, desoldering iron, flux, component, melt, bond	Giving instructions
7	Testers and meters	Brochure	oscilloscope, transistor tester, capacitance meter, signal generator, frequency counter, analog meter, isolation transformer, inductance meter, logic analyzer, spectrum analyzer, multimeter	Talking about price
8	Workspace	Magazine article	location, workbench, sturdy, surface, electrical service, power strip, lighting, swing arm, spot lighting, carpet	Making suggestions
9	Actions	Job advertisement	remove, lift, inspect, assemble, disassemble, modify, repair, analyze, calibrate, adjust, align, explain, recommend, clean	Asking for information
10	Actions 2	Occupational manual	stand, walk, sit, carry, push, pull, climb, kneel, crouch, reach, bend, twist, drive	Talking about past experiences
11	Work Settings	Classified ads	office, shop, factory, field, underground, elevated, tower, pole, construction site, studio, home	Disagreeing
12	Electrical safety	Safety poster	shock, live connection point, bare, terminal, circuit ground, jewelry, energized, non-conductive, contact, exposed, retain, turn off, discharge	Giving a warning
13	Math	Course description	fraction, root, power, add, subtract, multiply, divide, decimal, formula, ratio, proportion	Asking about frequency
14	Measurements	Article	inch, millimeter, centimeter, micron, milibar, watt-hour, decibel, phase angle, angular frequency, time constant	Asking for advice
15	Prefixes	Chart	prefix, terra (T), giga (G), mega (M), kilo (k), milli (m), micro (μ), nano (n), pico (p), value, symbol	Giving advice

Table of contents

1 Consumer electronics

Electronics Superstore is having a 2-Day Consumer Electronics Sale!

AUDIO ENTERTAINMENT - Buy a home **stereo** and add a set of **speakers**! Or choose a portable **MP3 player**!

VISUAL ENTERTAINMENT - Buy a brand new **television** to watch your favorite shows. Watch movies on your new television with your new **DVD player**!

Record life events with a new **digital camera** or **camcorder**! Then upload your photos and videos to your **computer** or **tablet**.

We also have **e-book readers** on sale. You can take your digital books with you everywhere!

Check out our **cell phones** on sale, too! Never miss another phone call!

Shop online or call us toll-free at 888-576-2346 to place your order!

Get ready!

1 Before you read the passage, talk about these questions.

1 What are some examples of consumer electronics?

2 What devices can people use to take pictures?

Reading

2 Read the Electronics Superstore advertisement. Then, choose the correct answers.

1 What is the purpose of this advertisement?
  - **A** to explain what consumer electronics are
  - **B** to advertise an electronics sale
  - **C** to promote a brand of e-readers
  - **D** to compare different electronics

2 Which of the following are NOT items on sale?
  - **A** computers
  - **B** e-book readers
  - **C** digital books
  - **D** tablets

3 What is a DVD player used for?
  - **A** to watch movies
  - **B** to read books
  - **C** to upload photos
  - **D** to make phone calls

Vocabulary

3 Match the words (1-8) with the definitions (A-H).

1 __ tablet

2 __ computer

3 __ television

4 __ e-book reader

5 __ cell phone

6 __ DVD player

7 __ MP3 player

8 __ consumer electronics

A a device that plays DVDs

B a digital music player

C a portable, hand-held computer

D a device that uses electrical signals to create picture and sound

E an electronic, hand-held device that displays contents of a book in digital format

F electronics used for everyday or casual entertainment purposes

G an electronic device that accepts, processes, and displays data

H a portable, wireless telephone

4 **Read the sentence pair. Choose where the words best fit the blanks.**

1 **stereo / camcorder**

A The __________ was very loud so I didn't hear you.

B We watched the video John shot with his __________.

2 **speaker / digital camera**

A Amy took pictures with a __________.

B The __________ was hooked up to the stereo.

3 **MP3 player / cell phone**

A Susan called me on her __________.

B Dave downloaded music to his __________.

5 **Listen and read the Electronics Superstore advertisement again. Which item is a good addition to the stereo?**

Listening

6 **Listen to a conversation between a customer and an employee. Mark the following statements as true (T) or false (F).**

1 __ The woman is calling to order a new tablet.

2 __ The man suggests ordering a DVD player.

3 __ The woman adds an MP3 player to the order.

7 **Listen again and complete the conversation.**

Employee:	Thanks for calling Electronics Superstore. How can **1** ______ ______ ______ today?
Customer:	I want to order the Musicmaster JLX **2** ______.
Employee:	Okay, great. What else can I do for you?
Customer:	I'd also like the **3** ______ that go with it.
Employee:	Those are also **4** ______ ______ right now.
Customer:	Really? That's great! Can you give me the total?
Employee:	It comes out to $295.99, before taxes and **5** ______ ______.
Customer:	Sounds good. Let me give you my **6** ______ ______.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

I want to order ...

What else ...

I'd also like the ...

Student A: You are a customer. Talk to Student B about:

- ordering an item on sale
- adding another item
- how much the items cost

Student B: You are an employee. Talk to Student A about the items he or she is ordering.

Writing

9 **Use the Electronics Superstore advertisement and the conversation from Task 8 to fill out the customer survey.**

ElecTronics
SUPERSTORE
Customer Survey

What did you purchase?

____

Why did you purchase these items?

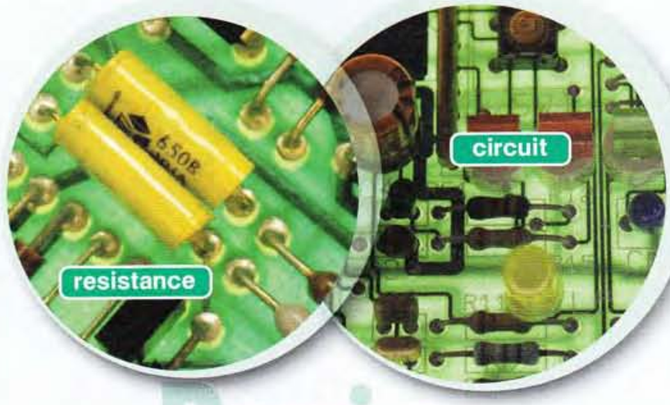
____

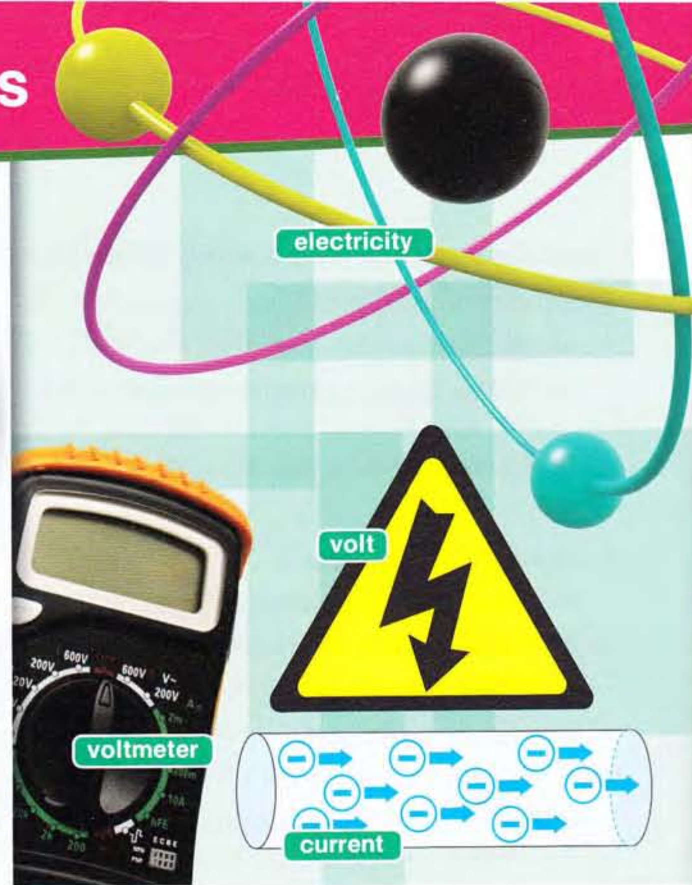
____

How did you place your order?

____

2 Electricity basics

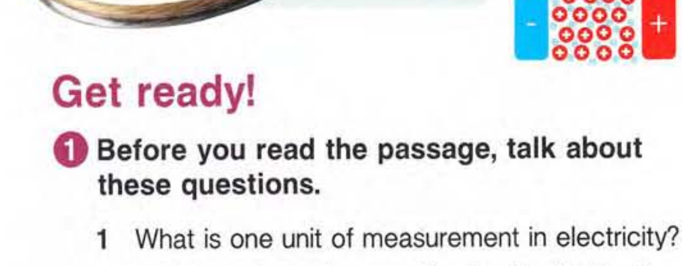




The Basics of Electricity

Professor Vanessa Thompson
Tuesday, Thursday 12-2

In this class, students learn about the basics of **electricity**. First, they learn how electricity is created. This leads to an in-depth study of **electrons**. Then students learn about electrical **charge**, **current**, and **resistance**. They also find out how a material **conducts** current. Finally, students learn how to measure electricity. They study units of measurement such as **amperes**, **volts**, **ohms**, and **watts**. At the end of the class, students do a final project. Each student builds his or her own electrical **circuit**.



Get ready!

1 Before you read the passage, talk about these questions.

1 What is one unit of measurement in electricity?
2 Why is copper wire used in electrical wiring?

Reading

2 Read the course description. Then, mark the following statements as true (T) or false (F).

1 __ Electrons are a unit of measurement.
2 __ Students learn about electrical currents.
3 __ The final project is a written exam.

Vocabulary

3 Match the words (1-8) with the definitions (A-H).

1 __ ampere
2 __ charge
3 __ circuit
4 __ conduct
5 __ current
6 __ electron
7 __ ohm
8 __ resistance

A the flow of electricity
B a unit that measures electrical resistance
C how much an object opposes an electric current passing through it
D a system of electrical conductors that electricity flows through
E the act of electricity passing through an object
F the electric property of an object that makes it have a negative or positive force
G the particle in an atom that carries electric currents
H the base unit of an electric current

4 **Choose the sentence that uses the underlined part correctly.**

1 A The electrical <u>circuit</u> is the base unit of current.
  B The battery produces low <u>volts</u> of electricity.

2 A The light bulb produces 60 <u>watts</u>.
  B He connected the <u>ampere</u> to the wire.

3 A The lightning <u>ohm</u> was so powerful, it knocked a tree down.
  B The <u>resistance</u> of an object depends in part on the material it's made from.

5 **Listen and read the course description again. What will students complete as a final project?**

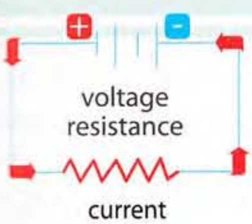
Listening

6 **Listen to a conversation between a professor and a student. Mark the following statements as true (T) or false (F).**

1 __ The student was confused about resistance.
2 __ The professor gave an example of an object with resistance.
3 __ The more resistance, the more current that passes through.

7 **Listen again and complete the conversation.**

Student: Excuse me, Professor Thompson. I was **1** ______ by some of the stuff you said today.
Professor: Okay. What were you confused about?
Student: Well, can you clarify what **2** ______ is, please?
Professor: Of course. Resistance is how much a material opposes an electrical **3** ______.
Student: Okay. But how does it **4** ______, exactly?
Professor: Some materials are made up of insulators that block current from passing through. This **5** ______ is electrical resistance.
Student: So, the **6** ______ current allowed through, the more resistance?
Professor: Exactly.



Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

Excuse me ...
Can you clarify ...
What's the difference ...

Student A: You are a student in an electronics course. Ask Student B about:
- something from the lecture you didn't understand
- units of measurement
- what the units measure

Student B: You are a professor in an electronics course. Talk to Student A about units of measurement.

Writing

9 **Use the course description and the conversation from Task 8 to fill out the student's notes.**

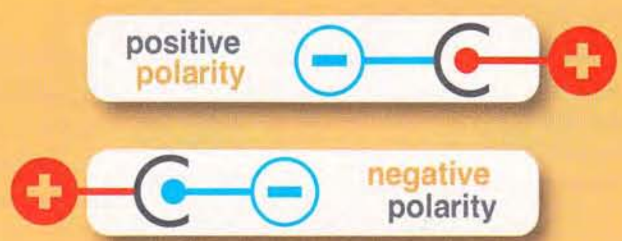
Electricity 101

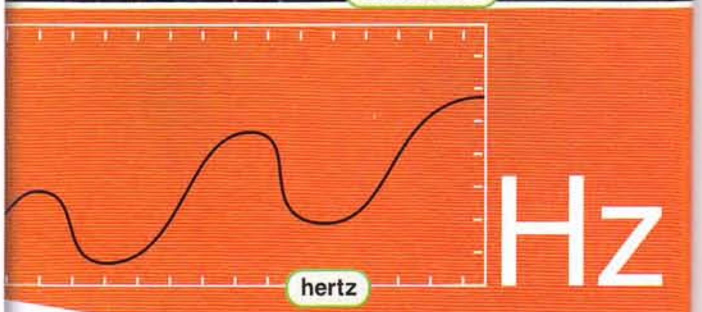
Monday, 8-10

What are some units of measurements for electricity?
______ and ______ are some ______.

How are they different?
______ measures ______.
and ______ measures ______.

3 Electricity basics 2





Introduction to Electricity

Direct current

Direct current is the type of electricity that comes from batteries. It moves from **negative** to **positive**.

Alternating current

Alternating current is when the **polarity** switches back and forth between positive and negative. The speed at which the polarity changes is measured in **hertz**. AC can be switched to DC using a **transformer** or diode. This process is known as **rectification**.

Additional Terms

Capacitance is the ability to store a quantity of electricity in an electric field. **Inductance** is the ability to store electricity in a magnetic field. The impact of capacitors and inductors on an alternating current is known as **reactance**. **Impedance** is a way of assessing how easily electricity passes through an electrical device.

Get ready!

1 Before you read the passage, talk about these questions.

1 What is the opposite of a negative charge?

2 What unit measures the speed at which current changes direction?

Reading

2 Read the textbook excerpt. Then, complete the table.

Electrical term	Relevant facts
direct current	____________ ____________
alternating current	____________ ____________
hertz	____________ ____________

Vocabulary

3 Match the words (1-5) with the definitions (A-E).

1 __ direct current
2 __ inductance
3 __ negative
4 __ positive
5 __ reactance

A having the electrical charge of a proton
B the opposition to a change in voltage or electrical current, as a result of capacitance or inductance
C the ability to store electricity in a magnetic field
D a flow of electrical current moving in one direction
E having the electrical charge of an electron

4 Read the sentence pair. Choose where the words best fit the blanks.

1 **impedance / hertz**

A ______ measure the pace at which polarity changes.

B ______ measures how difficult it is for electricity to move through electrical equipment.

2 **alternating current / capacitance**

A The flow of electricity continually changes direction with ______.

B ______ is the ability to store electricity in an electric field.

3 **transformer / polarity**

A ______ is when something has either a positive or negative electrical charge.

B A ______ is a piece of equipment that changes the voltage of electricity.

5 Listen and read the textbook excerpt again. Why is a transformer useful?

Listening

6 Listen to a conversation between an apprentice tech and an experienced tech. Mark the following statements as true (T) or false (F).

1 __ The woman talks about inductance.

2 __ Impedance is used to measure resistance.

3 __ The man understands the explanation given.

7 Listen again and complete the conversation.

Apprentice Tech: Can I ask you a question **1** ______ ______ electricity?

Experienced Tech: Sure. Go ahead.

Apprentice Tech: What is impedance? I don't really **2** ______ ______.

Experienced Tech: No problem. Impedance is a **3** ______ ______ ______. Are you with me so far?

Apprentice Tech: Yes. That part's fine. **4** ______ ______ ______ it measure?

Experienced Tech: Basically, impedance measures the amount that a circuit slows down the **5** ______ ______. Does that make sense?

Apprentice Tech: Actually, it does when you **6** ______ it like that. Thank you.

Experienced Tech: You're welcome.

Speaking

8 With a partner, act out the roles below based on Task 7. Then switch roles.

USE LANGUAGE SUCH AS:

Can I ask ...

I don't really ...

What about ...

Student A: You are an apprentice tech. Talk to Student B about:

- capacitance
- inductance
- understanding explanations

Student B: You are an experienced tech. Talk to Student A about capacitance and inductance.

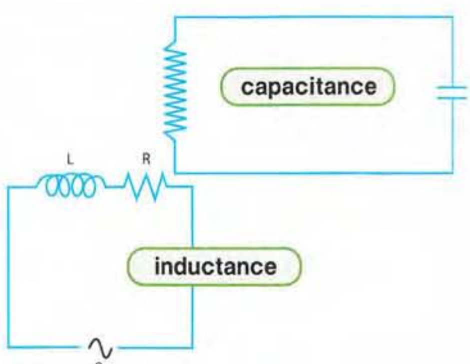
Writing

9 Use the textbook excerpt and the conversation from Task 8 to fill out the apprentice tech's notes.

Electrical terms

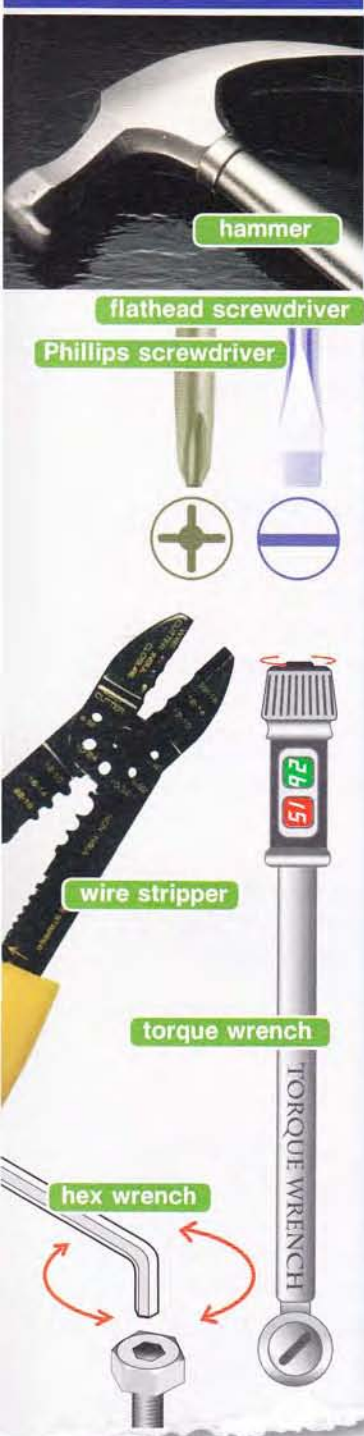
Capacitance: ______

Inductance: ______



4 Tools

Mr. Tech's WEEKLY ADVICE COLUMN



***Question:* I want to start repairing electronics. What sort of tools do I need to get started?**

Dear Reader,

Start by buying a **Phillips screwdriver** and **needlenose pliers**. These are two of the most basic tools. Phillips screws are most common in electronics. However, sometimes you'll see slotted ones. In this case, you'll need a **flathead screwdriver**. Another useful tool is a **hammer**. For electrical work, **diagonal cutters** are important. You will also need a **wire stripper** and **electrical tape**. A medical **hemostat** is also helpful to hold your wires.

After these basics, look into different types of wrenches. I suggest a **hex wrench** and a **torque wrench**. Also, a **magnifier** is helpful for detailed work.

Get ready!

1 Before you read the passage, talk about these questions.

1 What are some tools used when working on electronics?

2 What tools can be used for cutting wires?

Reading

2 Read the advice column. Then, choose the correct answers.

1 What is the purpose of the response?
- A to explain how to use a magnifier
- B to describe different types of wrenches
- C to list tools needed to repair electronics
- D to explain the importance of hammers

2 According to the passage, which item is used in a different profession?
- A diagonal cutter
- B wire stripper
- C hex wrench
- D hemostat

3 What tool is used with slotted screws?
- A torque wrench
- B flathead screwdriver
- C hammer
- D Phillips screwdriver

Vocabulary

3 Match the words (1-8) with the definitions (A-H).

1 __ hemostat
2 __ hammer
3 __ wire stripper
4 __ torque wrench
5 __ electrical tape
6 __ hex wrench
7 __ Phillips screwdriver
8 __ needlenose pliers

A a tool with a heavy metal head used for pounding or striking

B an L-shaped tool used for loosening or tightening screws and bolts with a head shaped like a hexagon

C a clamping tool used to clamp and hold wires

D small pliers with thin long jaws used for cutting and gripping in detailed work.

E a tool that uses a gauge to tighten nuts and bolts

F a tool used to cut and remove insulation from a wire

G tape made of plastic or vinyl used to insulate electrical wires

H a tool used to drive Phillips screws

4 **Read the sentence and choose the correct word.**

1 Jenna used her **Phillips screwdriver / flathead screwdriver** for slotted screws.

2 Henry used his **hex wrench / diagonal cutters** to cut the wires at an angle.

3 The **magnifier / hemostat** is very helpful for looking at details.

5 **Listen and read the advice column again. What are two of the most basic tools in electronics repair?**

Listening

6 **Listen to a conversation between an apprentice and a professional electrician. Mark the following statements as true (T) or false (F).**

1 __ The man already has a Phillips screwdriver.

2 __ The woman prefers plastic handles on screwdrivers.

3 __ The woman likes Klein needlenose pliers for professional work.

7 **Listen again and complete the conversation.**

Professional: Hi, nice to meet you. Do you **1** ______ ______ ______ ______?

Apprentice: Yes, I already have a **2** ______ ______.

Professional: That's good, but you'll need a **3** ______ ______, too.

Apprentice: Okay, I'll get one. **4** ______ ______ ______ a certain type?

Professional: Yes, I prefer the ones with **5** ______ ______ for a better grip.

Apprentice: Okay, thanks. And I also have Klein needlenose pliers.

Professional: Great. **6** ______ ______ ______ Klein needlenose pliers for professional work.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

You also need ...

I prefer ...

I really like ...

Student A: You are a professional electrician. Talk to Student B about:

- what tools he or she still needs to get
- what type of tool you prefer and why
- what brand of tool you prefer

Student B: You are an apprentice. Talk to Student A about which tools you need.

Writing

9 **Use the advice column and the conversation from Task 8 to make a list of advice from the professional electrician.**

Advice from the professional electrician

5 Tools 2

HOME ABOUT US SERVICES CONTACT

Everyday tools for easy repair

Classic City
ELECTRIC SUPPLY CO.

Product	Use
Glue gun	Multipurpose fastening for everyday needs
Super glue	Rapidly bonds glass, metal, plastic, and rubber
Alcohol	Removes oil, grease, and grime
Naphtha	Lifts grease and dirt from any surface
Magnet	Drives current through metal coils
Bench vise	Secures projects to a work bench
Stereo microscope	Magnifies images up to 200 times
Clip lead	Uses alligator clips on both ends
Cooler spray	Rapidly cools hardware and exposes faulty electrical components
Heatsink grease	Lubricates and protects overheating
Heat-shrink tubing	Securely repairs wires forming to contours and edges

Get ready!

1 Before you read the passage, talk about these questions.

1 What tool can be used to hold things in place?

2 What can be used to stick components to a surface?

Reading

2 Read the webpage. Then, mark the following statements as true (T) or false (F).

1 __ An electronics technician uses cooler spray to expose faulty hardware.

2 __ An electronics technician tests circuitry with a magnet.

3 __ Super glue is used to secure work to a table or bench.

Vocabulary

3 Match the words (1-8) with the definitions (A-H).

1 __ naphtha
2 __ alcohol
3 __ clip lead
4 __ glue gun
5 __ bench vise
6 __ heatsink grease
7 __ heat-shrink tubing
8 __ stereo microscope

A a chemical solution used as a cleaning agent

B a device that magnifies images

C melts plastic glue to attach wires to component surfaces

D a lubricant that stops components from overheating

E a short wire used to create an electrical current connection

F a petroleum product used to remove dirt from many surfaces

G a clamp that holds wood or metal in place

H a plastic tube that shrinks in diameter when heated

4 **Read the sentence and choose the correct word.**

1 The electronics technician secured the wire to the chip with **magnet / super glue**.

2 The computer's faulty wiring was exposed by the freezing **naphtha / cooler spray**.

3 The **clip lead / bench vise** clamped the stereo to the work table.

5 **Listen and read the webpage again. What can be used to get a very detailed image?**

Listening

6 **Listen to a conversation between a store clerk and a customer. Mark the following statements as true (T) or false (F).**

1 __ The man knows what he needs to buy.

2 __ The woman is familiar with types of electronics cleansers.

3 __ Alcohol is safe to use on all electronics wires and tubing.

7 **Listen again and complete the conversation.**

Clerk: Welcome to Classic City **1** ______ Supply. How may I help you?

Customer: Hi, I have a **2** ______. What do I use to clean wires?

Clerk: A product with naphtha easily **3** ______ ______.

Customer: What about an alcohol solution?

Clerk: Well, alcohol sometimes **4** ______ wires and tubing, so I recommend naphtha. It is used on many products.

Customer: I didn't know that. In that case, I need to **5** ______ some naphtha.

Clerk: It's a great cleanser. It works **6** ______ ______ on wiring projects.

Customer: Great, thanks for your help.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

Welcome to ...

What do I use ...

I think ...

Student A: You are a store clerk. Talk to Student B about:
- what he or she needs
- your recommendation
- why another product is not needed

Student B: You are a customer. Talk to Student A about what product you should buy.

Writing

9 **Use the webpage and the conversation from Task 8 to fill out the customer feedback form.**

Classic City Electric Supply Co.

Customer Feedback Form

What did you purchase?

____

Did you get help from an employee? Y / N

Was he or she helpful? If so, please explain.

____

____

____

Using a Soldering Iron

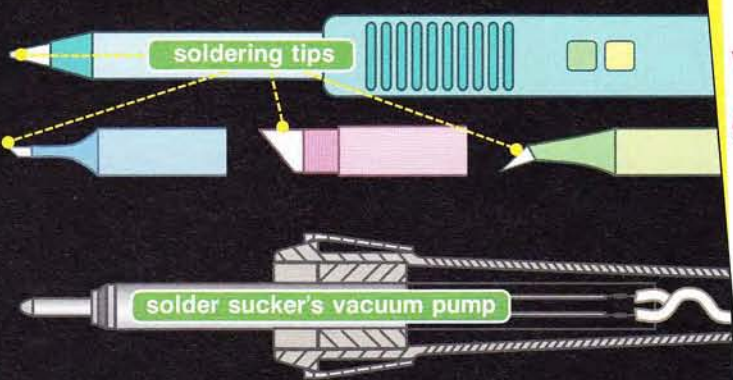
1 Before you start, make sure the **tip** is clean and shiny.

2 Now hold the **soldering iron** in one hand. Hold a long piece of **solder** in the other. The solder contains **flux**. This keeps surfaces clean and aids in the soldering process.

3 Next, place the two **components** together. Touch the area where they join with the soldering iron and solder.

4 Then pull the solder away. Hold the iron in place for another second to **melt** the solder.

5 Undo mistakes using a **desoldering iron**. A **solder sucker** uses a **vacuum pump** to **remove** old solder. **Solder wick** also removes solder. This is a copper braided material. Solder **bonds** to it when heated with a soldering iron.



Get ready!

1 Before you read the passage, talk about these questions.

1 What are some soldering tools?

2 What does a solder sucker use to remove old solder?

Reading

2 Read the instructions on using a soldering iron. Then, mark the following statements as true (T) or false (F).

1 __ It is important to clean the flux before soldering.

2 __ Pull away the soldering iron before pulling away the solder.

3 __ A solder sucker or a solder wick removes a mistake.

Vocabulary

3 Read the sentence and choose the correct word.

1 I need to **bond / remove** these two pieces together.

2 How many **components / tips** does the machine have altogether?

3 Don't heat plastic, or it will **bond / melt**!

4 **Place the words below under the correct heading.**

word BANK

solder desoldering iron tip
soldering iron solder wick flux
solder sucker vacuum pump

1 Equipment to join components	__________ __________
2 Equipment to remove mistakes	__________ __________
3 Parts of equipment	__________ __________

5 **Listen and read the instructions again. What does flux do?**

Listening

6 **Listen to a conversation between a tutor and a student. Mark the following statements as true (T) or false (F).**

1 __ The student has made a mistake.

2 __ The student has used a desoldering tool before.

3 __ The tutor tells the student to use solder wick.

7 **Listen again and complete the conversation.**

Tutor: Is everything all right? Have you bonded your **1** ______ together correctly?

Student: No, I've made a mistake. I've melted some **2** ______ in the wrong place.

Tutor: Don't worry. Just use a **3** ______ tool to remove it.

Student: Oh really? I haven't used one before.

Tutor: Well, this is a solder **4** ______.

Student: How does it work?

Tutor: It has a **5** ______ pump inside. Let me show you what to do.

Student: Thanks for **6** ______ ______ ______.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

Is everything all right?

I've melted some ...

How does it ...

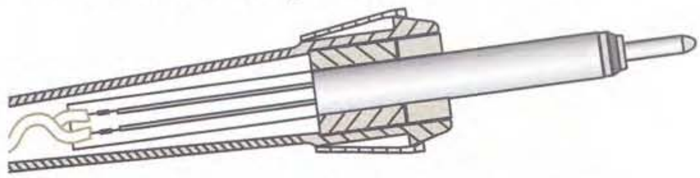
Student A: You are a student. Talk to Student B about:

- the type of mistake made
- what tool is used to fix it
- how the tool works

Student B: You are a tutor. Talk to Student A about what he or she needs to do to fix the mistake.

Writing

9 **Use the instructions on using a soldering iron and the conversation from Task 8 to fill out the tutor's assignment.**



How to remove solder with ________

____

____

____

____

____

____

____

____

QMT Readings

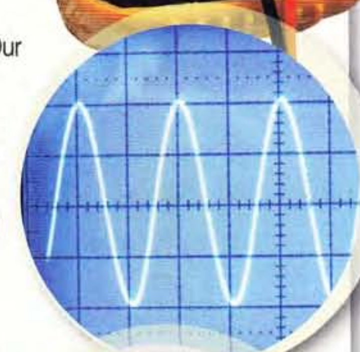
Providing Quality Meters and Testers for twenty years.


multimeter

Products

Meters

QMT offers high-quality meters. Our best-selling **multimeter** can measure voltage, resistance, and current! We also sell **inductance meters**, **capacitance meters**, and have both digital and **analog meters** in stock.



Scopes

Our new **oscilloscope** provides increased levels of accuracy. QMT listens to our clients. As a result, we recently added **spectrum analyzers** and **logic analyzers** to our stock.


signal generator

Other Testing Products

We carry **transistor testers**, **frequency counters**, and the ever-popular **signal generators**.


isolation transformer

Safety Devices

Keep your employees and equipment safe with an **isolation transformer**. Take advantage of our buy one get one half off promotion.

Our sales reps are waiting for your call.

Get ready!

1 Before you read the passage, talk about these questions.

1 What are some kinds of testers and meters?

2 What meter can measure various different values?


oscilloscope

Reading

2 Read the brochure. Then, mark the following statements as true (T) or false (F).

1 __ Multimeters check inductance and current.

2 __ QMT recently increased their inventory.

3 __ Isolation transformers are on sale.

Vocabulary

3 Read the sentence and choose the correct word.

1 The technician used the **frequency counter / analog meter** to track the speed of signal cycles.

2 A(n) **spectrum analyzer / isolation transformer** keeps power input and output separate.

3 A(n) **signal generator / analog meter** uses a moving needle to display measurements.

4 The man used a(n) **signal generator / inductance meter** to test the analog equipment.

5 The woman used an **isolation transformer / inductance meter** to get information about coils.

6 A **spectrum analyzer / frequency counter** shows voltage versus frequency.

4 Fill in the blanks with the correct words and phrases from the word bank.

Word BANK

capacitance meter logic analyzer multimeter oscilloscope transistor tester

1 The technician used the ______________ because she needed to measure both voltage and resistance.

2 The transistor wasn't working correctly, so the technician used a(n) ______________.

3 The technician wanted to smooth power output, so he fetched the ______________.

4 The technician used a(n) ______________ to create a graph showing voltage versus time.

5 A(n) ______________ show signals in a digital circuit.

analog meter

5 Listen and read the brochure again. What items did customers request the company begin carrying?

Listening

6 Listen to a conversation between a sales rep and an electronics tech. Choose the correct answers.

1 What is the electronic tech's main concern?

A quality of items
B availability
C shipping time
D cost of items

2 What will the electronics tech most likely do next?

A return an item
B place an order
C ask for more information
D go to the store

7 Listen again and complete the conversation.

Sales Rep:	This is Ted at QMT Readings. How may I help you?
Electronics Tech:	Hi, I'm an electronics tech. My company needs some more **1** ______ ______.
Sales Rep:	You called at a good time. We're **2** ______ ______ ______. Frequency counters are twenty percent off right now.
Electronics Tech:	Great. I need two counters with a range of 0.01 Hz to 3.7 GHz. What is the **3** ______ ______?
Sales Rep:	Each frequency counter is $375. The total **4** ______ ______ is $750.
Electronics Tech:	Does that price **5** ______ ______?
Sales Rep:	Shipping is **6** ______.
Electronics Tech:	Great.

Speaking

8 With a partner, act out the roles below based on Task 7. Then switch roles.

USE LANGUAGE SUCH AS:

I work for ...

There's a special ...

Does that price include ...

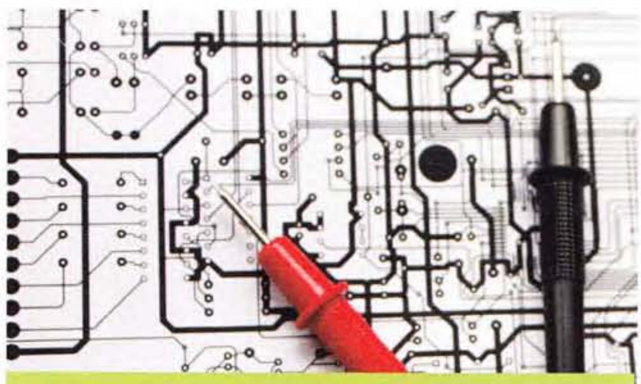
Student A: You are a sales rep for QMT Readings. Talk to Student B about:

- purchasing items
- available discounts
- shipping rates

Student B: You are an electronics technician. Talk to Student A about the items you need.

Writing

9 Use the brochure and the conversation from Task 8 to fill out the sales rep's order form.



SALES REP'S

Order Form

Item: ______________________

Price: ______________________

Quantity: ______________________

Shipping: ______________________

8 Workspace

SETTING UP YOUR WORKSPACE

by J. Adams

A good workspace is needed for electronics repair. You need to start with the right **location**. Find a quiet and clean area for your workspace. Avoid areas with thick or dark **carpet** in case you drop a small part.

Next you will need a large and **sturdy workbench**. The workbench **surface** must be clean and smooth. Another thing you need is a modern, grounded **electrical service**. Use a **power strip** to plug in extra devices.

You also must have good **lighting**. Use a **swing arm** lamp to provide **spot lighting**. Once you have a good workspace, you can get to work!

Get ready!

1 Before you read the passage, talk about these questions.

1 Where can electronic devices be worked on?
2 What is needed to provide electricity to devices?

Reading

2 Read the magazine article. Then, choose the correct answers.

1 What is the main idea of this article?
- A how to use a power strip
- B how to make a workbench
- C how to set up a workspace
- D how to repair electronics

2 Which of the following is NOT necessary for a good workspace?
- A carpet
- B a workbench
- C lighting
- D a clean area

3 What is a power strip used for?
- A to give spot lighting
- B to repair electronics
- C to smooth a surface
- D to plug in devices

Vocabulary

3 Match the words (1-7) with the definitions (A-G).

1 __ carpet
2 __ location
3 __ surface
4 __ workbench
5 __ lighting
6 __ power strip
7 __ electrical service

A a table where manual work is done, usually by mechanics or carpenters
B the function of having a supply of electric current
C a site or a place
D the outer or upper boundary of an object
E an item that has several electrical sockets and one plug
F a thick, heavy floor covering made of fabric
G the electrical equipment being used to provide light

4 **Write a word that is similar in meaning to the underlined part.**

1 The workbench was firmly built and solid, making it a good choice for a workspace.
_ t _ _ d y

2 The hinged rod on the lamp made it easy to move the light source as needed.
_ w _ _ g a _ _

3 John used focused, strong beam of light to see his work better.
s _ _ t _ i g _ t _ n _

5 **Listen and read the magazine article again. Why is it important to have a power strip for your workspace?**

Listening

6 **Listen to a conversation between an electronics technician and an employee at a store. Mark the following statements as true (T) or false (F).**

1 __ The woman needs help repairing electronics.

2 __ The man recommends starting with a workbench.

3 __ The man suggests a swing arm lamp.

7 **Listen again and complete the conversation.**

Customer: Hi, I'm looking for some items to set up my **1** ______ ______.

Employee: Okay, great. What kind of work do you do?

Customer: I repair electronics. What **2** ______ ______ ______?

Employee: You should start with a workbench that is **3** ______ ______ ______ enough.

Customer: Okay, thanks. And I will also need **4** ______.

Employee: **5** ______ ______ ______ a swing arm lamp for spot lighting?

Customer: Good idea. Is there anything else that I need?

Employee: Yes, **6** ______ ______ are also very important. Let's take a look at them.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

I recommend ...

May I suggest ...

Make sure ...

Student A: You are an employee. Help Student B with getting items to set up his or her workspace:
- ask what type of work he or she does
- advise what electrical outlets are needed
- offer other suggestions

Student B: You are a customer. Talk to Student A about what you need for your new workspace.

Writing

9 **Use the magazine article and the conversation from Task 8 to write a shopping list with descriptions of what to buy for a customer's new workspace.**

NEW WORKSPACE
Notes

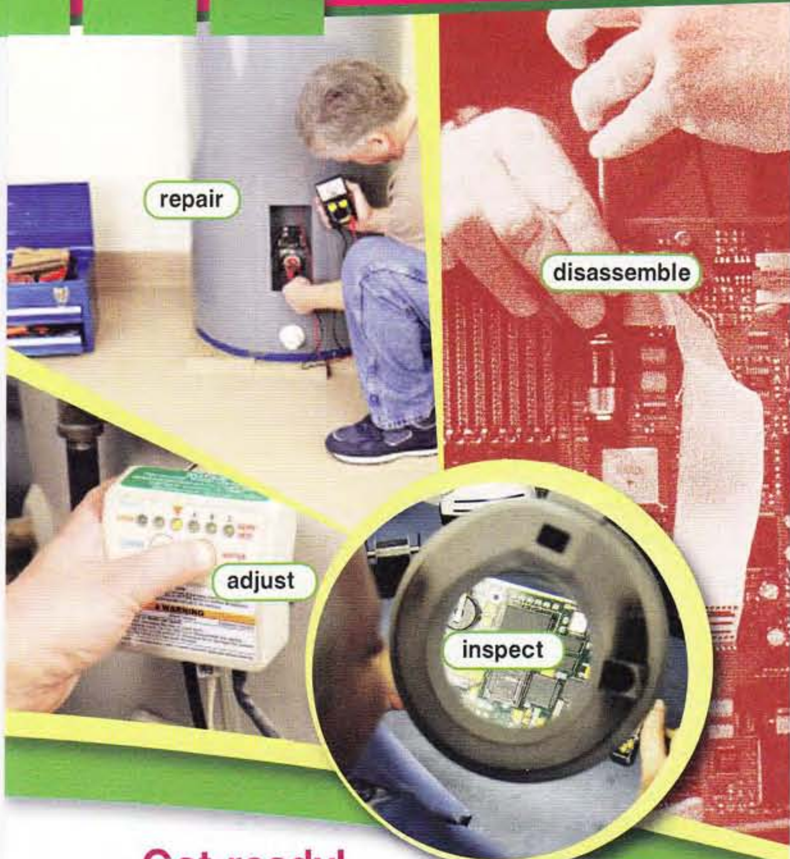
Electrical outlets needed - ______________________

____

____

Other advice - ______________________

____



Senior Electronics Technician

Company: QLZ Industries

Employee Type: Full-Time

Duties of a technician:

- **assemble**, test, and document models designed by electrical engineers
- **analyze** data and **recommend** improvements to models
- **explain** recommendations and **adjust** models accordingly
- **inspect** circuitry
- **disassemble** circuitry to **clean** or **repair** it
- **modify** circuitry by **calibrating** and **aligning** it
- must be able to **lift** 30lb, in order to reposition or **remove** equipment

Educational requirements: at least two years of higher education in the electronics field

Experience: at least three years as a full-time electronics technician

Pay rate: depends on experience

Get ready!

1 Before you read the passage, talk about these questions.

1 What are some actions electronics technicians must perform?

2 What needs to be done when parts are dirty or greasy?

Reading

2 Read the job advertisement. Then, choose the correct answers.

1 What is the purpose of the advertisement?

A to advertise the opening of a new company
B to inform people that a company has moved
C to describe services a company offers
D to announce a job opening at a company

2 Who should apply for this job?

A people with three years of experience
B people with physical limitations
C people who want to work part-time
D people with degrees in education

3 Which is NOT part of a technician's job?

A assessing data
B lifting equipment
C designing models
D fixing circuitry

Vocabulary

3 Fill in the blanks with the correct words from the word bank.

WORD BANK

analyzed assembled aligned explained lifted modified removed

1 The technician ____________ the unwanted equipment from the lab.

2 The two technicians ____________ the heavy electronics equipment onto the table.

3 The senior technician ____________ the responsibilities of the job to the new hire.

4 The man ____________ the model so that it worked better.

5 The technician ____________ the different parts until they were all in a straight line.

6 The woman ____________ the data carefully then made a chart of her findings.

7 The man ____________ the many parts of the model until it was complete.

4 **Write a word that is similar in meaning to the underlined part.**

1 The technician needs to take apart the circuitry in order to fix it. _ _ s a _ _ e _ _ l e
2 The man carefully examined the delivery of electronics equipment to ensure that everything was present. _ n _ _ e _ t _ d
3 The woman got the dirt off the model. c _ _ a _ _ d
4 The technicians worked all night to fix the broken device. _ e _ a _ r
5 The man slightly moved the knobs on the equipment so that they were lined up. _ _ j u _ _ e d
6 The technician's report made suggestions about ways to improve the model. _ e c _ _ m _ n _ _ d
7 The scientific instrument needed to be changed to be more accurate. _ _ l _ b _ a _ _ d

5 **Listen and read the job advertisement again. What is the salary of an electronics technician?**

Listening

6 **Listen to a conversation between an interviewer and an applicant. Mark the following statements as true (T) or false (F).**

1 __ The man needs more education.
2 __ The man feels he is a good leader.
3 __ The woman is impressed by the man's references.

7 **Listen again and complete the conversation.**

Interviewer: So, why do you want to become our senior electronics technician?
Applicant: Well, I have both **1** ______ and the necessary education.
Interviewer: Please tell me about your previous **2** ______ ______.
Applicant: I was part of a team that **3** ______ ______ ______ models.
Interviewer: Excellent. Do you think of yourself as a **4** ______ ______?
Applicant: Yes. I **5** ______ ______ with others. But I am also comfortable leading a team.
Interviewer: Your references are great. However, I do have other **6** ______ to interview.
Applicant: I understand.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

I have both ... / Tell me about ...

Then I ...

Student A: You are an interviewer. Talk to Student B about:
- the position
- education
- job experience

Student B: You are a job applicant. Talk to Student A about the position.

Writing

9 **Use the job advertisement and the conversation from Task 8 to fill out the applicant's resume.**

Resume

Education: ______________________

____

Experience: ______________________

____

Suitability: ______________________

____

10 Actions 2

Get ready!

1 Before you read the passage, talk about these questions.

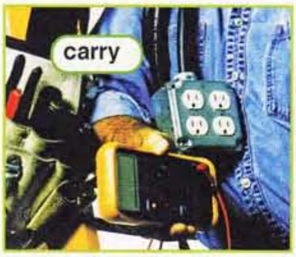
1 What action is required when using a screwdriver?

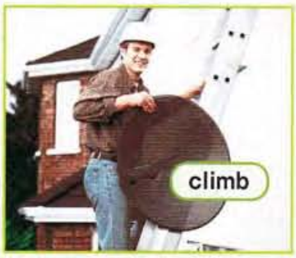
2 What action is required when using a ladder?

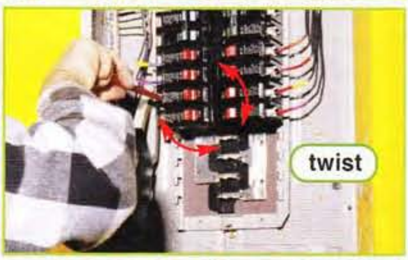
Occupational Manual *34*

Job Duties

Electronics Technician PHYSICAL







1 Technicians frequently have to **stand** and **walk**. This takes place in the office, or at the job site.

2 Technicians need to **sit** at a workbench for two hour stretches. They also sit when **driving** between job locations.

3 Technicians often **carry** items that weigh up to 30 lbs. Occasional **pushing** or **pulling** is needed.

4 Technicians sometimes **climb** stairs to reach job sites. It is sometimes necessary to climb ladders.

5 Technicians regularly **bend**, **crouch**, **reach**, **kneel**, and **twist**, while making repairs.

6 Technicians constantly use both their arms and hands during work.

Reading

2 Read the occupational manual. Then, mark the following statements as true (T) or false (F).

1 __ Technicians frequently have to walk between job sites.

2 __ Technicians regularly carry items that weigh up to 30lb.

3 __ Technicians often crouch and twist while working.

Vocabulary

3 Read the sentence and choose the correct word.

1 Maria struggled to **reach / bend** the book on the high shelf.

2 Michael **twists / drives** to get to his friend's house.

3 The tech **pushes / carries** his toolbox inside.

4 Clare **bends / drives** to pick up the screw she dropped.

5 The tech wanted to **sit / carry** at the workbench.

6 Kate **reaches / pushes** the power button to see if the device works.

7 Jim **twists / sits** the screw of the appliance loose.

4 Read the sentence pair. Choose where the words best fit the blanks.

1 **climbs / kneeled**

A The tech ____________ on the floor in front of the TV.

B The workman ____________ the ladder so that he can get to the roof.

2 **stand / walk**

A Martin had to ____________ because there were not enough chairs.

B Nicole decided to ____________ rather than take the bus.

3 **pulled / crouched**

A The woman ____________ down to fix the broken pipe.

B The man ____________ on the car handle and the door opened.

5 Listen and read the occupational manual again. When do technicians need to climb?

Listening

6 Listen to a conversation between a new tech and an experienced tech. Choose the correct answers.

1 What is the conversation mostly about?

- A the ways to avoid soreness
- B the physical demands of the job
- C the experienced tech's complaints
- D the variety of duties on the job

2 What was the experienced tech's hardest experience on the job?

- A carrying 20 lbs of weight
- B walking up two flights of stairs
- C kneeling for six hours
- D climbing a ladder

7 Listen again and complete the conversation.

New Tech:	I've just 1 ______ ______. What's the work like?
Experienced Tech:	Pretty good. 2 ______ ______ from job to job.
New Tech:	What was your hardest job?
Experienced Tech:	Once I spent six hours kneeling. I was doing repairs. 3 ______ ______ ______ can be tough on the back sometimes, too.
New Tech:	I bet. Do you have to 4 ______ a lot?
Experienced Tech:	We rarely have to carry 5 ______ ______ 30 pounds. I remember one time the elevator didn't work.
New Tech:	What happened?
Experienced Tech:	I had to carry 30 pounds up 6 ______ ______ of stairs! That was rough.

Speaking

8 With a partner, act out the roles below based on Task 7. Then switch roles.

USE LANGUAGE SUCH AS:

What's the ...

Once I spent ...

We rarely ...

Student A: You are a new tech. Talk to Student B about:

- the nature of the work
- their hardest job
- weight carried

Student B: You are an experienced tech. Talk to Student A about the job.

Writing

9 Use the occupational manual and the conversation from Task 8 to fill out a job advertisement for an electronics technician.

Job advertisement

Position:
electronics technician

Physical description: ______

Requirements: ______

Lifting limits: ______

11 Work settings

Part-time Electronics Technician (nights and weekends)

Channel 11 News needs an indoor electronics technician. The technician will maintain the **studio's** camera equipment and **tower**. This person will also service equipment in the **office**. Please email channel11.hr@elevenstudios.net if interested.

Full-time Electronics Technician

Satellite Network needs a full time technician. This position is based in our **factory**. Occasional work in the **field** is required. Applicants should be comfortable working at **elevated** heights. Many field jobs are located on **poles**. Other field jobs include repairs in customer's **homes**. Please send resume to bryanlincoln@satellitenetwork.com.

Temporary Electronics Technician (4-6 weeks)

This position includes work in the **shop** and **construction site**. Construction site work consists of **underground** wiring. C & M Construction requires at least three years' experience. Click here to apply.

Get ready!

1 Before you read the passage, talk about these questions.

1 Where are some places an electronics technician works?

2 In which settings is working at elevated heights required?

Reading

2 Read the classified ads. Then, choose the correct answers.

1 What is the main purpose of the article?
- A to describe electronics technician jobs
- B to describe electronics technician settings
- C to advertise technician position openings
- D to describe where field jobs are located

2 Where is Satellite Network's position based?
- A the field
- B the factory
- C the office
- D the studio

3 C & M Construction's work does NOT occur in which area?
- A elevated levels
- B the shop
- C the construction site
- D underground

Vocabulary

3 Match the words (1-6) with the definitions (A-F).

1 __ office
2 __ field
3 __ factory
4 __ construction site
5 __ underground
6 __ elevated

A location where building occurs
B located above ground level
C location away from the main workplace
D below ground level
E indoor location where people go to do work
F location where goods are made and distributed

4 Write a word that is similar in meaning to the underlined part.

1 The location where electronics or machinery is fixed was very busy today. s _ o _
2 The lights on the structure raised above ground level needed to be fixed. t _ w e _
3 The wind caused the telephone cylinder-shaped object that is longer than its width to fall over. _ o _e
4 The place where television shows are made needs a full-time electronics technician. s _ _ d _ o
5 The location where a person lives needs new light fixtures in every room. h _ _ e

5 Listen and read the classified ads again. Which position does not involve outdoor work?

Listening

6 Listen to a conversation between two electronics technicians. Mark the following statements as true (T) or false (F).

1 __ The man's ideal work setting is outdoors.
2 __ The woman does not like heights.
3 __ The man likes working inside as much as outside.

7 Listen again and complete the conversation.

Electronics Tech 1:	What's your ideal job **1** ______?
Electronics Tech 2:	I think working outdoors is the best, especially when the job is up **2** ______.
Electronics Tech 1:	Why do you like to do that?
Electronics Tech 2:	I like being where I can see everything. It's also very quiet.
Electronics Tech 1:	I don't think that sounds nice at all. I'm afraid of **3** ______.
Electronics Tech 2:	Well, what kind of job setting do you **4** ______?
Electronics Tech 1:	I think it's better to be **5** ______, with my feet firmly on the ground.
Electronics Tech 2:	I don't **6** ______ I'd like that at all.

Speaking

8 With a partner, act out the roles below based on Task 7. Then switch roles.

USE LANGUAGE SUCH AS:

What's your ideal ...
I don't think ...
I think ...

Student A: You are an electronics technician. Talk to Student B about:

- your ideal job setting
- why that is your ideal job setting
- what your colleague thinks

Student B: You are an electronics technician. Talk to Student A about your ideal job setting.

Writing

9 Use the classified ads and the conversation from Task 8 to fill out the applicant's email.

To: channel11.hr@elevenstudios.net
From: cohen.j@broadband.net
Subject: Part-time Position Inquiry

Good Afternoon,

My name is ______. I'm emailing to inquire about the part-time electronics ______ position.

I have prior experience working in a radio ______. I have also worked in a ______ where I fixed small electronic appliances.

12 Electrical safety

Get ready!

1 Before you read the passage, talk about these questions.

1. What is an example of a non-conductive material?
2. What should workers not wear when working with electricity?

The insides of electrical products are often unsafe. Always follow these steps when working on electronics.

Always wear shoes with soles made of a **non-conductive** material, like rubber. Never service equipment barefoot. Take off **jewelry** and watches before starting work. Shocks often happen when rings come into **contact** with **terminals**. Watch out for **bare** and **exposed** wires. **Turn off** circuitry at the plug before working on it. Don't touch **live connection points** or you'll get a **shock**! Keep your hands away from the **circuit ground**. People often get shocked when they touch it. Some parts **retain** huge charges even after power is shut off. **Discharge** these parts yourself using a discharge tool.

Safety First!

Reading

2 Read the poster on safety. Then, choose the correct answers.

1 What is the purpose of the poster?

- A to describe parts of a circuit
- B to explain how to repair a circuit
- C to advise how to stay safe
- D to explain how charges travel through a circuit

2 What do people need to wear when working on a circuit?

- A rubber soled shoes
- B a watch
- C jewelry
- D gloves

3 Which of the following is NOT dangerous to touch?

- A the plug
- B exposed wires
- C a terminal
- D the circuit ground

Vocabulary

3 Read the sentence pair. Choose where the words best fit the blanks.

1 **bare / exposed**

- A Never service equipment in ____ feet.
- B Be careful not to touch ____ wires.

2 **live / non-conductive**

- A Rubber shoes are best because rubber is __________.
- B Don't touch that wire! It's __________!

3 **contact / shock**

- A Make sure your watch doesn't come into __________ with any wires.
- B People often get a __________ if they aren't careful

4 **retain / discharge**

- A That machine can __________ a charge even when it's turned off.
- B You need to __________ electrical equipment before starting work.

4 **Match the words (1-5) with the definitions (A-E).**

1 __ jewelry
2 __ terminal
3 __ turn off
4 __ connection point
5 __ circuit ground

A gold and silver decorations worn on someone's fingers, hands and neck
B a place on the circuit where two wires join
C the place where used current goes, also called "earth"
D A point where conductors end and connect to external circuits
E Stop power from entering an electric circuit

5 **Listen and read the poster again. Why shouldn't you touch live connection points?**

Listening

6 **Listen to a conversation between a technician and his apprentice. Check (✓) what the apprentice forgot to do.**

1 ❑ Put on rubber shoes.
2 ❑ Remove her watch.
3 ❑ Take off her jewelry.
4 ❑ Turn off the circuit.

7 **Listen again and complete the conversation.**

Technician: Stop! Don't put your hands in the machine yet!
Apprentice: What's wrong?
Technician: You need to take off your **1** ______. If your silver ring touches any bare wires, you'll get a nasty shock.
Apprentice: I thought silver was **2** ______.
Technician: No! Silver is very **3** ______!
Apprentice: Oh, okay. But I've already turned off the circuit, so I can't get a **4** ______.
Technician: That doesn't matter. Some parts **5** ______ an electrical charge even when the machine isn't connected to the power supply.
Apprentice: Okay, thanks for the **6** ______.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

Stop!
What should ...
You'll need ...

Student A: You are an electronics technician. Talk to Student B about:
- not working on the machine yet
- why not
- what to do

Student B: You are an apprentice. Talk to Student A about what you are doing wrong.

Writing

9 **Use the poster on safety and the conversation from Task 8 to fill out the electrical safety poster.**

Electrical safety
Dos and Don'ts

Always: ____________________
____
____

Never: ____________________
____
____

13 Math

Get ready!

1 Before you read the passage, talk about these questions.

1 What is 0.5 as a fraction?

2 What is a math statement that shows two ratios are equal?

Area of rectangle = L x W

formula

proportion

a:b = b:d

Course Description for Electronics Math 101

This course teaches math skills to electronics students.

Two basic concepts that will be taught are **fractions** and **decimals**. Students will learn how to **add** and **subtract** fractions and decimals. Later, students will learn how to **multiply** and **divide** fractions and decimals. All of these skills will be tested in the Final Exam.

After these basics, more difficult concepts will be taught. Students will learn how to find the **root** of a number. They will also understand how to use the **power** of a number. These new skills will be used to complete math **formulas**.

Students will also understand **ratios** and **proportions** by the end of the course.

X

multiply

4^2

power

3/4

fraction

+

add

Reading

2 Read the course description. Then, choose the correct answers.

1 What is the purpose of this course description?

A to list concepts to be studied in the course

B to describe ratios and proportions

C to list items that will be on the Final Exam

D to explain how to multiply decimals

2 Which of the following will NOT be taught in the course?

A how to multiply fractions

B how to add decimals

C how to divide proportions

D how to subtract decimals

3 What will the root and power of a number be used for?

A ratios

B decimals

C proportions

D formulas

Vocabulary

3 Match the words (1-8) with the definitions (A-H).

1 __ add

2 __ subtract

3 __ multiply

4 __ divide

5 __ ratio

6 __ power

7 __ root

8 __ proportion

A shows that two ratios are equal to each other

B take away a number from another number

C shows how many times the number is multiplied by itself

D the original number that multiplies by itself to reach the other larger number

E increase a number a certain amount of times

F combine numbers to form another total number

G decrease a number a certain amount of times

H shows the relation between two or more values

4 Read the sentence and choose the correct word.

1 Jenna used a **decimal / power** to show the number in units of ten.

2 Henry made a **formula / proportion** using symbols to make a statement.

3 A **root / fraction** is useful to show one whole number being divided by another.

5 Listen and read the course description again. What will students learn about fractions?

Listening

6 Listen to a conversation between a student and a teacher. Mark the following statements as true (T) or false (F).

1 __ The man wants to know how to multiply fractions.

2 __ The woman says that adding ratios is important.

3 __ The woman explains how adding decimals is used in work.

7 Listen again and complete the conversation.

Student: Well, I'm wondering **1** ______ ______ ______ ______ actually use math as an electronics technician.

Teacher: Technicians **2** ______ ______ ______ ______ in their work. You have to have basic math skills to be a good technician.

Student: What are **3** ______ ______ ______ ______ that I'd need to know?

Teacher: It's important to know how to **4** ______ ______.

Student: Oh, do technicians need to do that **5** ______ ______ ______ their work?

Teacher: Yes, they usually need to **6** ______ ______ of electronic parts.

Speaking

8 With a partner, act out the roles below based on Task 7. Then switch roles.

USE LANGUAGE SUCH AS:

How often ...

What are some basic skills ...

Technicians need to ...

Student A: You are a student. Talk to Student B about:

- Why the math course is important
- What are some basic math skills used
- How often do they use this skill

Student B: You are a teacher. Talk to Student A about why math is important for electronics technicians.

Writing

9 Use the course description and the conversation from Task 8 to write a reason for taking the math course and some skills that will be useful.

Why I need to take this math course?

Reason: ______________________________

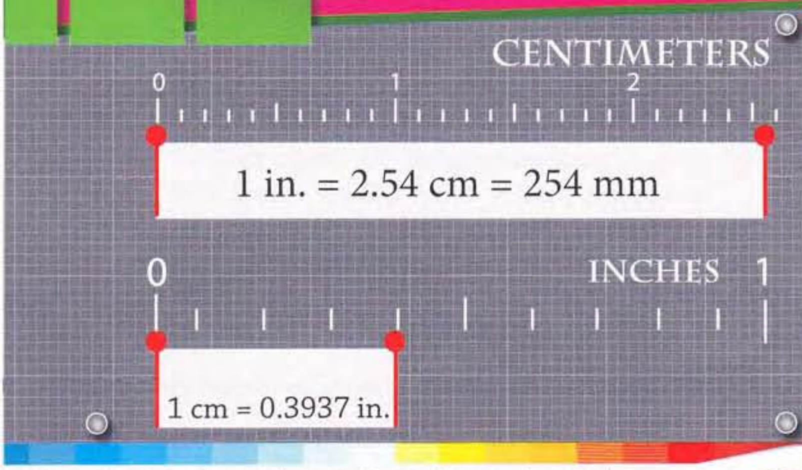
____

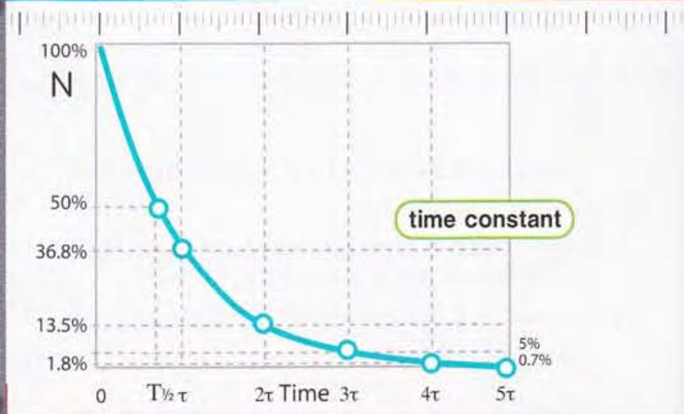
Skills: ______________________________

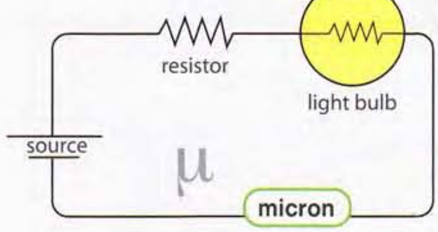
____

____

14 Measurements







Get ready!

1 Before you read the passage, talk about these questions.

1 What is audio voltage measured in?

2 What is atmospheric pressure measured in?

Reading

2 Read the article. Then, choose the correct answers.

1 What is the main purpose of the article?

A to describe a technician's job

B to show how to calculate information

C to describe different measurement units

D to discuss different calculating formulas

2 Which of the following is NOT a measurement unit?

A an angular frequency

B a micron

C a watt-hour

D a variable

3 What of the following units does NOT measure an object's length/width?

A a millimeter

B a millibar

C a micron

D an inch

Measurement units in electronics

Electronics technicians collect information by utilizing different measurement units. These units include the **inch**, **centimeter**, **millimeter**, and **micron**. These units help technicians calculate an object's width and length. Technicians sometimes need to measure energy use. They use the **watt-hour** to measure power loads. And they use the **decibel** to measure audio voltages and current pressure.

Technicians also measure **angular frequency** and **phase angle**. These units measure differences between different wave forms. Technicians also need to measure time differences. For those situations, they use the **time constant** formula. It helps them calculate reaction times for certain variables. Lastly, technicians also measure atmospheric pressure. The **millibar** enables them to calculate this number.

Vocabulary

3 Choose the sentence that uses the underlined part correctly.

1 A I am an <u>inch</u> taller than she is.

B She used the <u>angular frequency</u> formula to calculate the atmospheric pressure.

2 A The amplifier produced about 250 <u>microns</u> of sound.

B The technician found that the wire was about a <u>centimeter</u> too short.

3 A The tiny component measured four <u>microns</u> across.

B The electrical current lasted for two <u>watt-hours</u>.

4 **Match the words (1-7) with the definitions (A-G).**

1 ___ millibar
2 ___ phase angle
3 ___ millimeter
4 ___ watt-hour
5 ___ decibel
6 ___ time constant
7 ___ angular frequency

A difference of degrees between voltage and current wave forms
B amount of energy a circuit uses in one hour
C increase in the voltage, current, or power
D measures an object's length/width, is one thousandths of a meter
E measurement of reaction time for the output value to reach 63.7%
F measures atmospheric pressure
G a unit used to represent the relationship between different wave forms

5 **Listen and read the article again. Why do electronics technicians need to measure time differences?**

Listening

6 **Listen to a conversation between two technicians. Mark the following statements as true (T) or false (F).**

1 ___ The wire seemed to be a bit too long.
2 ___ The man said he would use a longer wire.
3 ___ The woman was grateful for the help.

7 **Listen again and complete the conversation.**

Experienced Tech: What are you working on?

Apprentice Tech: I'm just re-wiring this **1** ______. But I have a question.

Experienced Tech: What is it?

Apprentice Tech: This **2** ______ seems to be a bit short. Do you think I should use a longer wire or just use this one?

Experienced Tech: I think you should use a **3** ______ wire. It'll work better.

Apprentice Tech: What **4** ______ do you think it should be?

Experienced Tech: I would use one at least an **5** ______ or two longer than the one you have now.

Apprentice Tech: Okay, I'll do that. **6** ______ for the help.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

What are you ...
I have a ...
I would ...

Student A: You are an apprentice technician. Talk to Student B about:

- repairing an amplifier
- using a certain wire length
- using the technician's suggestion

Student B: You are an experienced technician. Talk to Student A about the length of wire he or she should use.

Writing

9 **Use the article and the conversation from Task 8 to fill out the work report.**

Work REPORT

Date: December 13
Submitted by: Jack Farrow
Work order #: 23587

I completed work order #23587 on December 13.

This ________ took approximately two hours to complete. The ________ was not working properly due to the wiring. The wire was about ________ too ________.

I replaced it with the right-sized wire. The computer is now in ________ order. I do not foresee any future ________.

15 Prefixes

Prefix	Symbol	Value
terra	T	one trillion or 1,000,000,000,000
giga	G	one billion or 1,000,000,000
mega	M	one million or 1,000,000
kilo	k	one thousand or 1,000
milli	m	one thousandth or 0.001
micro	μ	one millionth or 0.000001
nano	n	one billionth or 0.000000001
pico	p	one trillionth or 0.000000000001

Get ready!

1 Before you read the passage, talk about these questions.

1 What are some prefixes of numbers?

2 Which is larger, giga, or mega?

Reading

2 Read the chart. Then, choose the correct answers.

1 What number does the prefix "milli" stand for?

A 0.000001 C 0.001
B 1,000,000 D 1,000

2 What is the symbol for one trillionth?

A G C T
B m D p

3 What prefix does the symbol μ represent?

A micro C pico
B nano D giga

Vocabulary

3 Match the words (1-7) with the definitions (A-G).

1 __ pico
2 __ terra
3 __ kilo
4 __ value
5 __ mega
6 __ giga
7 __ nano

A one thousand
B one million
C one billion
D an object or number's worth
E one trillionth
F one billionth
G one trillion

4 **Fill in the blanks with the correct words from the word bank.**

Word BANK

milli   prefix   micro   symbol

1 I used a __________ instead of writing the whole number.
2 The disk drive only stores one thousandth of a byte, or a __________ byte.
3 Shorten the phrase "one millionths of a second" to the word __________ second.
4 The __________ for the subtraction sign is a dash.

5 **Listen and read the chart again. What is the prefix for the smallest number on the chart?**

Listening

6 **Listen to a conversation between two electronics technicians. Mark the following statements as true (T) or false (F).**

1 __ The woman wrote her report quickly.
2 __ The man suggested using prefixes.
3 __ The man wants to help the woman save time.

7 **Listen again and complete the conversation.**

Experienced Tech: Hi Jane. I just finished reading your **1** ______.

New Tech: What did you think of it?

Experienced Tech: I thought it was **2** ______ and well written.

New Tech: Thank you. I spent a few hours **3** ______ on it.

Experienced Tech: Let me give you a little **4** ______ for your next report.

New Tech: Okay. What's that?

Experienced Tech: Use **5** ______ to abbreviate the large numbers. It will save you a good amount time.

New Tech: Oh I hadn't thought of that. I'll definitely **6** ______ to do that.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

I just finished ...

Let me give ...

Try using ...

Student A: You are an experienced technician. Talk to Student B about:

- your thoughts on the report
- using symbols in the report
- saving time writing the report

Student B: You are a new technician. Talk to Student A about your report.

Writing

9 **Use the chart and the conversation from Task 8 to fill out the new technician's email.**

To: **johnson.andrew@milleniumelectronics.net**

From: __________ **@milleniumelectronics.net**

Re: **December Report**

Hi Mr. Johnson,

Here is my __________ for December. I wanted to thank you for giving me those suggestions about using __________ for larger words. My report did not take as long to write this time. I will be doing some __________ in my next report. Would it be okay to make a table? I thought it would be easier to compare __________ that way. Please let me know.

Sincerely,

____

Glossary

add [V-T-U13] To **add** numbers is to combine them to form another total number.

adjust [V-T-U9] To **adjust** is to alter or move something slightly, in order to improve it.

alcohol [N-UNCOUNT-U5] **Alcohol** is a chemical solution and is used as a cleaning agent.

align [V-T-U9] To **align** is to arrange things so that they make a straight line or are in the right position, in relation to other objects.

alternating current [N-UNCOUNT-U3] **Alternating current** is a flow of electrical current that continually changes direction at a quick rate.

ampere [N-COUNT-U2] An **ampere** is the base unit of electric current. It is equal to one coulomb per second.

analog meter [N-COUNT-U7] An **analog meter** is an old-fashioned device that shows measurements by means of a moving needle. It is useful for showing slow fluctuating voltages and small dips and spikes of voltage.

analyze [V-T-U9] To **analyze** is to study something carefully, in order to explain or understand it.

angular frequency [N-UNCOUNT-U14] The **angular frequency** is a unit that represents the relationship between different wave forms.

assemble [V-T-U9] To **assemble** is to put the different parts of something together.

bare [ADJ-U12] If a wire is **bare**, it is uncovered.

bench vise [N-COUNT-U5] A **bench vise** is a clamp that holds wood or metal in place to be worked on with tools.

bend [V-I-U10] To **bend** is to move forward and downward, so that you are not upright.

bond [V-T-U6] To **bond** things together is to stick them together.

calibrate [V-T-U9] To **calibrate** is to change or check an instrument or tool, in order to make it more accurate.

camcorder [N-COUNT-U1] A **camcorder** is a device that combines a video camera, recorder, and player.

capacitance [N-UNCOUNT-U3] **Capacitance** is the ability to store an amount of electricity in an electric field.

capacitance meter [N-COUNT-U7] A **capacitance meter** is a device used to smooth power output. It is known for being unreliable.

carpet [N-UNCOUNT-U8] **Carpet** is a thick, heavy floor covering made of fabric.

carry [V-T-U10] To **carry** is to hold something with your hands or arms, and then take it somewhere.

cell phone [N-COUNT-U1] A **cell phone** is a portable, wireless telephone.

centimeter [N-COUNT-U14] A **centimeter** is a measurement unit used to determine an object's length or width and is one hundredth of a meter.

charge [N-COUNT-U2] A **charge** is the physical property of an object that makes it undergo a negative or positive force when it is near another electrically charged object.

circuit [N-COUNT-U2] A **circuit** is a system of electrical conductors that electricity flows through.

circuit ground [N-COUNT-U12] The ground or **circuit ground** is the place in the circuit where the current goes after it has been used. It is also called the earth.

clean [V-T-U9] To **clean** something is to get the dirt off something.

climb [V-I-U10] To **climb** is to use your feet and hands in order to travel up, down, over or across something.

clip lead [N-COUNT-U5] A **clip lead** is a short wire that is used to create an electrical current connection.

component [N-COUNT-U6] A **component** is one part of a piece of equipment. Many components are used to build larger machines.

computer [N-COUNT-U1] A **computer** is an electronic device that accepts, processes, and displays data.

conduct [V-T-U2] For electricity to **conduct**, it passes through an object.

connection point [N-COUNT-U12] A **connection point** is a place where two parts of a circuit meet.

construction site [N-COUNT-U11] A **construction site** is a location where building or remodeling is done.

consumer electronics [N-PLURAL-U1] **Consumer electronics** are electronics used for everyday or casual entertainment purposes.

contact [N-COUNT-U12] If you come into **contact** with something, you touch it.

cooler spray [N-UNCOUNT-U5] **Cooler spray** is a freeze spray used to expose faulty parts in hardware.

crouch [V-I-U10] To **crouch** is to move your body closer to the ground by completely bending your knees.

current [N-UNCOUNT/COUNT-U2] **Current** is the flow of electricity.

decibel [N-COUNT-U14] A **decibel** represents an increase in either the voltage, current, or power in a speaker or amplifier and is equal to one tenth of a bel.

decimal [N-COUNT-U13] A **decimal** is a number shown in units of ten.

desoldering iron [N-COUNT-U6] A **desoldering iron** is a tool used to remove solder.

diagonal cutters [N-COUNT-U4] **Diagonal cutters** are pliers with angled cutting jaws used to cut wires.

digital camera [N-COUNT-U1] A **digital camera** records images in a digital form instead of using film.

direct current [N-UNCOUNT-U3] **Direct current** is a flow of electrical current that moves in just one direction.

disassemble [V-T-U9] To **disassemble** is to take something apart, so that it is in pieces.

discharge [V-T-U12] If you **discharge** something, you remove its electrical charge.

divide [V-T-U13] To **divide** numbers is to decrease a number a certain amount of times.

drive [V-T or I-U10] To **drive** is to operate a vehicle so that it moves somewhere.

DVD player [N-COUNT-U1] A **DVD player** is a device that plays DVDs, most commonly used with a television.

e-book reader [N-COUNT-U1] An **e-book reader** is an electronic, hand-held device that displays the contents of a book in digital format.

electrical service [N-UNCOUNT-U8] **Electrical service** refers to the function of having a supply of electric current.

electrical tape [N-UNCOUNT-U4] **Electrical tape** is tape made of plastic or vinyl used to insulate electrical wires

electricity [N-UNCOUNT-U2] **Electricity** is a form of energy that occurs naturally or can be produced. It is expressed in terms of movement and interactions of electrons.

electron [N-COUNT-U2] An **electron** is the particle in an atom that carries electric currents.

elevated [ADJ-U11] If a job is at an **elevated** level, it is physically higher than ground level.

explain [V-T-U9] To **explain** is to tell someone something in a way that is easy to follow.

exposed [ADJ-U12] If a wire is **exposed**, it can easily be seen or touched.

factory [N-COUNT-U11] A **factory** is an indoor location where goods are made and distributed.

field [N-UNCOUNT-U11] The **field** is an outdoor location or any location where work is done away from the main workplace.

flathead screwdriver [N-COUNT-U4] A **flathead screwdriver** has a flat blade at the tip and is used with slotted screws.

flux [N-UNCOUNT-U1] **Flux** is a soft metal. You can melt it and use it to join pieces of metal together.

formula [N-COUNT-U13] A **formula** uses symbols to make a statement.

fraction [N-COUNT-U13] A **fraction** represents one whole number being divided by another.

frequency counter [N-COUNT-U7] A **frequency counter** is a device that counts a signal's frequency. It does this by opening a gate, and tracking the number of signal cycles that pass through before the gate closes again.

giga [PREFIX-U15] The word **giga** attached to the beginning of a word stands for the number one billion.

glue gun [N-COUNT-U5] A **glue gun** melts plastic glue, to affix wires to component surfaces.

hammer [N-COUNT-U4] A **hammer** is a tool with a heavy metal head that is used for pounding or striking.

heat-shrink tubing [N-UNCOUNT-U5] **Heat-shrink tubing** is plastic tubing that shrinks in diameter when heated and is used to repair and insulate wires.

heatsink grease [N-UNCOUNT-U5] **Heatsink grease** is a lubricant that prevents components from overheating.

hemostat [N-COUNT-U4] A **hemostat** is a clamping tool used to clamp and hold wires.

hertz [N-COUNT-U3] A **hertz** is a measurement of frequency. It measures the speed at which electrical current changes direction.

hex wrench [N-COUNT-U4] A **hex wrench** is an L-shaped tool used for loosening or tightening screws and bolts with a head shaped like a hexagon.

home [N-COUNT-U11] A **home** is an indoor location in which a person lives.

impedance [N-UNCOUNT-U3] **Impedance** is a measure of how hard it is for electricity to pass through a piece of electrical equipment.

inch [N-COUNT-U14] An **inch** is a unit of measurement that is used to determine an object's length or width and is one twelfth of a foot.

inductance [N-UNCOUNT-U3] **Inductance** is the ability to store electricity in a magnetic field.

inductance meter [N-COUNT-U7] An **inductance meter** is a device used to find out the inductance value of coils.

inspect [V-T-U9] To **inspect** is to examine something carefully, with the goal of making sure that it is correct or good enough.

isolation transformer [N-COUNT-U7] An **isolation transformer** is a transformer that moves electrical power to equipment, while keeping the power input and power output apart. This is a safety measure.

jewelry [N-UNCOUNT-U12] **Jewelry** is decorative things you wear on your hands, fingers, and neck. It is often made of gold or silver.

kilo [PREFIX-U15] The word **kilo** attached to the beginning of another word stands for the number one thousand.

kneel [V-I-U10] To **kneel** is to move into a position where your body is resting on your knees.

lift [V-T-U9] To **lift** is to move something in an upwards direction, so that it is in a higher position.

lighting [N-UNCOUNT-U8] **Lighting** refers to the electrical equipment used to provide light.

live [ADJ-U12] If a circuit is **live**, electricity is traveling through it.

location [N-COUNT-U8] A **location** is a site or a place.

logic analyzer [N-COUNT-U7] A **logic analyzer** is a device that displays signals in a digital circuit. It can show the relationships between different variables. It is similar to an oscilloscope.

magnet [N-COUNT-U5] A **magnet** is an object that is able to produce an invisible magnetic field which can interact with metals, such as copper, iron, or nickel.

magnifier [N-COUNT-U4] A **magnifier** enlarges the appearance of an object to allow for detailed viewing.

mega [PREFIX-U15] The word **mega** attached to the beginning of a word stands for the number one million.

melt [V-I-U6] To **melt** something is to turn it from a solid into a liquid.

micro [PREFIX-U15] The word **micro** attached to the beginning of a word stands for one millionth of a number.

micron [N-COUNT-U14] A **micron** is a measurement unit used to determine an object's length or width and is equal to one millionth of a meter.

milli [PREFIX-U15] The word **milli** attached to the beginning of another word stands for one thousandth of a number.

millibar [N-UNCOUNT-U14] A **millibar** is a unit of measurement that measures atmospheric pressure and is equal to one thousandth of a bar.

millimeter [N-COUNT-U14] A **millimeter** is a measurement unit used to determine an object's length or width and is one thousandth of a meter.

modify [V-T-U9] To **modify** something is to make minor changes to something, with the goal of improving it.

MP3 player [N-COUNT-U1] An **MP3 player** is a digital music player that supports and plays MP3 files.

multimeter [N-COUNT-U7] A **multimeter** is a piece of equipment that can measure several different things. It can measure voltage, resistance, and current.

multiply [V-T-U13] To **multiply** a number is to increase a number a certain amount of times.

nano [PREFIX-U15] The word **nano** attached to the beginning of another word stands for one billionth of a number.

naphtha [N-UNCOUNT-U5] **Naphtha** is a petroleum product and is used to remove dirt from any surface.

needlenose pliers [N-PLURAL-U4] **Needlenose pliers** are small pliers with thin, long jaws used for cutting and gripping in detailed work.

negative [ADJ-U3] If something is **negative**, it has the electrical charge of an electron.

non-conductive [ADJ-U12] If a material is **non-conductive**, electricity cannot pass through it.

office [N-COUNT-U11] An **office** is an indoor location where people go to do work.

ohm [N-COUNT-U2] An **ohm** is a unit that measures electrical resistance.

oscilloscope [N-COUNT-U7] An **oscilloscope** is a device that creates a graph showing voltage against time.

phase angle [N-UNCOUNT-U14] A **phase angle** is the difference of degrees between forms of a voltage wave and a current wave that have the same time.

Phillips screwdriver [N-COUNT-U4] A **Phillips screwdriver** is used to drive in Phillips screws.

pico [PREFIX-U15] The word **pico** attached to another word stands for one trillionth of a number.

polarity [N-UNCOUNT-U3] **Polarity** is the condition of having either a negative or positive electrical charge.

pole [N-COUNT-U11] A **pole** is an object that is shaped like a cylinder and has a length that is far greater than its width.

positive [ADJ-U3] If something is **positive**, it has the electrical charge of a proton.

power [N-COUNT-U13] The **power** of a number shows how many times the number is multiplied by itself.

power strip [N-COUNT-U8] A **power strip** consists of several electrical sockets that use one plug to connect to an electricity source.

prefix [N-COUNT-U15] A **prefix** is a meaning that is added to the beginning of a word.

proportion [N-COUNT-U13] A **proportion** shows that two ratios are equal to each other.

pull [V-I-U10] To **pull** is to cause someone or something to move towards you, by using your hands.

push [V-I-U10] To **push** is to cause someone or something to move away from you or from their current position, by using your hands.

ratio [N-COUNT-U13] A **ratio** shows the relation between two or more values.

reach [V-I-U10] To **reach** is to cause part of your body to move in a direction towards something you want to touch or pick up.

reactance [N-UNCOUNT-U3] **Reactance** is the opposition to a change in voltage or electrical current that is caused by capacitance or inductance.

recommend [V-T-U9] To **recommend** is to advise or make suggestions, particularly when a person has special knowledge about something.

rectification [N-UNCOUNT-U3] **Rectification** is the process of AC switching to DC.

remove [V-T-U9] To **remove** is to take an object away from its current position or place.

repair [V-T-U9] To **repair** something is to fix something that is broken or that does not work correctly.

resistance [N-UNCOUNT-U2] **Resistance** is how much an object opposes an electric current passing through it.

retain [V-T-U12] If you **retain** something, you hold or keep it for a long period of time.

Glossary

root [N-COUNT-U13] The **root** of a number is the original number that multiplies by itself to reach the other larger number.

shock [N-COUNT-U12] A **shock** is a sudden pain caused by electricity traveling through the body.

shop [N-COUNT-U11] A **shop** is an indoor location where electronics or machinery are maintained or fixed.

signal generator [N-COUNT-U7] A **signal generator** is a device that tests whether electrical equipment is working, by sending a test signal into the equipment. It is mostly used to test analog equipment.

sit [V-I-U10] To **sit** is to have the lower part of your body on a seat, chair, or the ground, while the upper part of your body is upright.

solder [N-UNCOUNT-U6] **Solder** is a soft metal. You can melt it and use it to join pieces of metal together.

soldering iron [N-COUNT-U6] A **soldering iron** is a tool used to heat solder and join pieces of metal together.

solder sucker [N-COUNT-U6] A **solder sucker** is a tool which removes solder using a vacuum pump.

solder wick [N-UNCOUNT-U6] **Solder wick** is copper thread which removes solder.

speaker [N-COUNT-U1] A **speaker** is a device used to emit sound from an electronic device that plays music.

spectrum analyzer [N-COUNT-U7] A **spectrum analyzer** is a kind of scope that shows voltage against frequency.

spot lighting [N-UNCOUNT-U8] **Spot lighting** focuses a strong beam of light over a small, concentrated area.

stand [V-I-U10] To **stand** is to be in an upright position, supported by your feet.

stereo [N-COUNT-U1] A **stereo** is an electronic device used to play music.

stereo microscope [N-COUNT-U5] A **stereo microscope** is a device that magnifies images with two beams of light.

studio [N-COUNT-U11] A **studio** is an indoor location where television and radio programmes are made and broadcast or where music is recorded.

sturdy [ADJ-U8] If an object is **sturdy**, it is solid and firmly built.

subtract [V-T-U13] To **subtract** one number from another is to take it away from the other number.

super glue [N-UNCOUNT-U5] **Super glue** is an adhesive that can rapidly bond to plastic, metal, rubber, or glass.

surface [N-COUNT-U8] The **surface** of an object is the outer or upper boundary of it.

swing arm [N-COUNT-U8] A **swing arm** is a hinged rod on a lamp that allows movement.

symbol [N-COUNT-U15] A **symbol** is a sign that represents an object or means something.

tablet [N-COUNT-U1] A **tablet** is a portable, hand-held computer.

take off [PHRASAL V-U12] If you **take off** clothing or jewelry, you remove it from your body.

television [N-COUNT-U1] A **television** is a device that receives electrical signals and uses them to display pictures and produce sound.

terminal [N-COUNT-U12] A **terminal** is the point where a conductor in an electrical device ends and connects to an external circuit.

terra [PREFIX-U15] The word **terra** attached to the beginning of a word stands for the number one trillion.

time constant [N-UNCOUNT-U14] The **time constant** is the reaction time for the output value to reach 63.7% of the highest or lowest output value when exposed to a different type of input.

tip [N-COUNT-U6] A **tip** is the end of something, for example, the part of a pen which touches the paper.

torque wrench [N-COUNT-U4] A **torque wrench** uses a gauge to tighten nuts and bolts with the desired amount of force.

tower [N-COUNT-U11] A **tower** is a structure that is located above ground level and is supported by tall beams.

transformer [N-COUNT-U3] A **transformer** is a device that alters the voltage of a flow of electricity.

transistor tester [N-COUNT-U7] A **transistor tester** is a device that measures how well transistors work. Some transistor testers measure how a transistor reacts to a real signal. Others measure approximate gain, high-frequency cutoff point, and leakage.

turn off [PHRASAL V-U12] If you **turn off** electrical equipment, you remove it from the power source.

twist [V-I-U10] To **twist** is to turn something, such as your body, so that it is in a different position.

underground [PREP-U11] If something is **underground**, it is located below ground level.

vacuum pump [N-COUNT-U6] A **vacuum pump** is a piece of equipment. You can use it to move gases and liquids.

value [N-UNCOUNT-U15] **Value** refers to an object's worth or importance.

volt [N-COUNT-U2] A **volt** is a unit used to measure the electric force of an object.

walk [V-I-U10] To **walk** is to move in a forward direction, by placing one foot in front of the other.

watt [N-COUNT-U2] A **watt** is a unit that measures power. It is equivalent to one joule per second.

watt-hour [N-COUNT-U14] A **watt-hour** is the amount of energy that a circuit uses in one hour.

wire stripper [N-COUNT-U4] A **wire stripper** is used to cut and remove insulation from a wire.

workbench [N-COUNT-U8] A **workbench** is a table or bench where manual work is done, usually by mechanics or carpenters.

Career Paths

Electronics

Book 2

Virginia Evans
Jenny Dooley
Carl Taylor

Express Publishing

Scope and sequence

Unit	Topic	Reading context	Vocabulary	Function
1	Causes of product failure	Article	failure, mortality, mechanical wear, corrosion, heat stress, physical stress, power surge, wear out, break down, resistance, reversed polarity, electrical stress	Breaking bad news
2	Initial evaluation	Guide	manufacturer, in common, age, abuse, conditions, in operation, idle, sudden, gradual, exhibit, evaluation	Giving an opinion
3	External evaluation	Checklist	malfunctioning, external, eliminate, dead, hum, hiss, activity, display, scramble, warm up, tap, remote control, apart	Getting someone to stop
4	Circuits	Course description	origin, wire, series, component, parallel, leg, closed, open, short circuit, shorted, rectify, reservoir, stage, active element, circuit	Troubleshooting
5	Signals	Textbook excerpt	signal, amplitude, analog, waveform, cycle, frequency, sine wave, harmonic energy, square wave, rise time, fall time, duty cycle, sawtooth wave, phase relationship, digital, analog-to-digital converter	Making comparisons
6	Capacitors	Catalog page	capacitor, plate, insulator, ceramic capacitor, plastic capacitor, electrolytic capacitor, tantalum capacitor, trimmer capacitor, mark, rating, farad, range	Offering advice
7	Crystals and resonators	Web tutorial	quartz, ceramic, crystal, slice, slab, resonator, piezoelectric effect, filter, encased, lead, generate, vibrate	Giving assurances
8	Diodes	Textbook excerpt	valve, cathode, anode, rectifier, double rectifier, bridge rectifier, band, biasing element, pulse, light-emitting diode (LED), peak inverse voltage (PIV), maximum, diode	Guessing
9	Fuses	Instructions	protect, exceed, blow, slow-blow fuse, cylinder, fuse, rectangular, spring, coil, hot side, surface-mount, holder	Eliciting information
10	Chips (Integrated circuits)	Press release	chip, silicon, transistors, microscopic, defective, custom, small scale integrated chip (SSI), large scale integrated chip (LSI), graphics card, fan,	Giving compliments
11	Resistors	Work order	resistor, limit, opposition, carbon composition resistor, wire-wound resistor, dissipate, disintegrate, color code, represent, metal oxide resistor, interchange	Solving a problem
12	Potentiometers	Webpage	potentiometer (pot), trimpot, substrate, wiper, terminal, resistance curve, rheostat, linear taper pot, log taper pot, audio taper pot, rotary, gang, isolate, shaft	Asking for a recommendation
13	Relays and switches	Trade magazine article	relay, contact, pole, normally open, normally closed, throw, control, switch, passage, variety, unconnected, shut down	Talking about duration
14	Transistors	Article	amplify, bipolar transistor, base, emitter, collector, junction field effect transistor (JFET), gate, source, drain, metal-oxide semiconductor field-effect transistor (MOSFET), enhancement mode, depletion mode, bias	Making apologies
15	Voltage regulators	Manual	incoming, regulate, linear regulator, series pass transistor, compensate, switching regulator, charge up, alter, output, pulse-width modulation (PWM), detect, zener diode, voltage regulator	Setting on a course of action

Table of contents

1 Causes of product failure

Why do Products Break Down?

There are several reasons why electronic equipment **breaks down**. First, there is always some infant **mortality** among newly-built products. Design errors often cause equipment **failure** early on.

Many problems in electronic equipment are due to **mechanical wear**. Moving parts wear out. Sometimes **corrosion** develops in the circuit board component connections. Solder joints sometimes fail and develop **resistance**. These problems prevent normal circuit operation.

Televisions and other large electronic products may fail because of **heat stress**. Power supplies create heat which can damage electronic circuits.

Electrical stress is another problem. Lightning can produce **power surges** and burn out equipment. **Reversed polarity** is also very damaging. This happens when people install batteries the wrong way.

Physical stress is another cause of product failure. One example of physical stress is when drinks are spilled on equipment. People may drop their machines, or they could get handled the wrong way in transit. However, sometimes components just **wear out** from overuse.

Get ready!

1 Before you read the passage, talk about these questions.

1 What are some causes of product failure?
2 What can cause a power surge?

Reading

2 Read the article. Then, choose the correct answers.

1 According to the article, which is NOT a cause of mechanical wear?
   A power surge
   B damaged parts
   C component corrosion
   D solder joint resistance

2 How does heat stress occur?
   A from lightning power surges
   B from batteries being installed incorrectly
   C from the power supply overheating
   D from the overuse of electronic devices

3 What can be inferred about physical stress?
   A It is the result of a design flaw
   B It is common in newer products
   C It develops naturally over time
   D It is caused by product owners

Vocabulary

3 Match the words (1-6) with the definitions (A-F).

1 __ mechanical wear
2 __ reversed polarity
3 __ electrical stress
4 __ mortality
5 __ heat stress
6 __ physical stress

A failure or death
B the damage caused by the way products are treated
C the backwards flow of current in a circuit
D the damage caused by heat generated from the power supply
E the damage caused from a large surge of power
F the damage caused when moving parts break

4 **Read the sentence pair. Choose where the words best fit the blanks.**

1 **wore out / broke down**

A Our car ____________ on the highway.

B He used his tools so much that they ____________.

2 **corrosion / failure**

A Water on metal surfaces often leads to ____________.

B James can't find the cause of the equipment ____________.

3 **power surge / resistance**

A A ____________ could damage your computer.

B ____________ in the circuit stops the current from flowing.

5 **Listen and read the article again. What kinds of stress causes machines to fail?**

Listening

6 **Listen to a conversation between a technician and a customer. Mark the following statements as true (T) or false (F).**

1 __ The woman determined the laptop broke due to electrical stress.

2 __ The man used his laptop while at the beach.

3 __ The woman thinks that the man should get a new laptop.

7 **Listen again and complete the conversation.**

Technician: Yes, of course. I'm afraid I have some bad news. There's some **1** ______ ______.

Customer: What does that mean?

Technician: There is some **2** ______ in the connections. Possibly the laptop got wet at some point.

Customer: It probably happened when I took it to the **3** ______.

Technician: Well, I hate to tell you this, but salt water is a big cause of **4** ______ ______.

Customer: Is it?

Technician: Yes. People put a lot of **5** ______ ______ on their electronic equipment these days.

Customer: So, can you repair my **6** ______?

Technician: I can, but I'm afraid it will be expensive. It would be cheaper to buy a new one.

Customer: But I've only had it two years!

Technician: I'm sorry, but components inside the laptop are damaged. That shortens the product's lifespan.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

I'm afraid I have some ...

It's caused by ...

I can ...

Student A: You are an electronics technician. Talk to Student B about:

- what the damage to the device is
- how the damage probably happened
- what you advise him or her to do

Student B: You are a customer. Talk to student A about your electronic device.

Writing

9 **Use the article and the conversation from Task 8 to fill out the technician's notes.**

Notes

Product: ____________

Problem: ____________

____

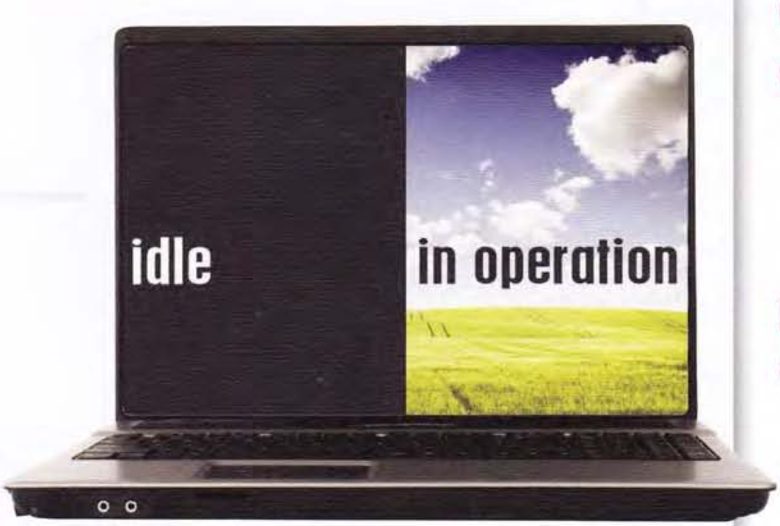
Probable cause: ____________

____

Suggestion: ____________

____

2 Initial evaluation



Evaluation of a Faulty Electronic Device

When a customer brings a faulty item for repair it's useful to know its history. This can help you to evaluate what the problem is.
First, find out the **manufacturer** and model. Products from specific companies may have design faults. Even different models may have faulty parts **in common**.
Second, find out the product's **age**. Old products may have faults due to normal wear and tear. Newer products may have problems linked to recent, faulty technology. Ask the customer how they treat it. Maybe they **abused** the equipment unknowingly. In what **conditions** is the product used? At home or outdoors?
Next, ask about what the product was doing when it failed. Was it **in operation** or sitting **idle**? Did it **exhibit** any strange behavior before it shut down? Find out whether the failure was **gradual** or **sudden**. Dirty or worn components cause gradual product failure. If parts blow, failure is sudden.

Get ready!

1 Before you read the passage, talk about these questions.

1 How can a person cause product failure?
2 What is the opposite of a device being in operation?

Reading

2 Read the guide. Then, mark the following statements as true (T) or false (F).

1 __ Different products from the same manufacturer often have the same components.
2 __ Older products often fail because of faulty technology.
3 __ Products fail suddenly if parts blow.

Vocabulary

3 Choose the correct word.

1 The camera's failure was **gradual / sudden** so no one was surprised.
2 Owners **abuse / exhibit** their electronics by treating them roughly.
3 The two different models of television have a lot of components in **operation / common**.
4 Angie was shocked by the **sudden / gradual** break down of her computer.
5 The screen **exhibited / manufactured** strange lines just before it shut off.

4 Write a word that is similar in meaning to the underlined part.

1 If the product is faulty, you should send it back to the company that made it. m _ _ _ f _ _ _ _ _ e _
2 Many people leave their televisions switched on but not in use. _ _ _ e
3 Knowing the number of years since the manufacture of a product can help diagnose problems. _ _ e
4 You shouldn't use your laptop in wet environments. _ _ n _ _ t _ _ _ _
5 You should turn off your computer when it is not being used. i _ o _ _ _ _ _ i _ _

5 🎧 **Listen and read the guide again. What is a common problem with old products?**

Listening

6 🎧 **Listen to a conversation between a technician and a customer. Check (✓) the information the woman asks about.**

1 ☐ Manufacturer
2 ☐ Age
3 ☐ Use
4 ☐ Condition
5 ☐ Value

7 🎧 **Listen again and complete the conversation.**

Technician: Hello, this is LapTech. Can I help you?

Customer: Yes, I've got a problem with my laptop. It's stopped working. I'd like for you to take a look at it.

Technician: Of course. Can I ask some questions first? Who is the **1** ______?

Customer: It's Bell. The model is BL0899.

Technician: And its **2** ______?

Customer: It's about 3 years old. I bought it new.

Technician: Did it **3** ______ ______ suddenly, or was it gradual?

Customer: It was fine and then one day it **4** ______ stopped working.

Technician: And is it in **5** ______ ______?

Customer: Sure. I look after it well, I don't abuse it.

Technician: Well, it sounds like an **6** ______ ______ ______ to me. Your model has a lot of parts in common with the BL088. That one has a problem with circuit failures.

Customer: That's not what I wanted to hear.

Technician: Bring it by the shop anyway, just so I can be sure.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

I've got a problem with ...
Did it stop ...
I think it could ...

Student A: You are a technician. Ask Student B about:

- the manufacturer of the PC
- the laptop's age and condition
- whether it stopped working gradually or suddenly

Student B: You are a customer. Talk to Student A about your broken PC.

Writing

9 **Use the guide and the conversation from Task 8 to fill out the technician's notes.**

Notes

Product: ______

Manufacturer: ______

Model: ______

Age: ______

How did it stop working?

______

______

Suspected problem

______

______

Suggested action

______

______

3 External evaluation

You have a **malfunctioning** electronic device. But you don't know why it's not working. So, you want to take it **apart**. But wait! Don't do that. It may take hours to find the problem. Instead, **eliminate** some issues by examining the **external** parts first. Check the following:

1 When the device is on, is there any **activity**? Do you hear a **hiss** or **hum**? If you do, the device isn't **dead**. The problem is probably the power supply.

2 Are there any **scrambled** words on the **display**? If so, a computer chip is broken.

3 **Tap** on the device. Does this make the machine work better? Yes? Then the problem is a bad connection.

4 Does the device stop working after it **warms up**? This is also the result of a bad connection.

5 Is the **remote control** working correctly? If not, you may need to replace it.

Hopefully, now you know the problem and how to fix it!

Get ready!

1 Before you read the passage, talk about these questions.

1 Where are words and pictures shown on an electronic device?

2 What might appear on the screen of a laptop if there is a problem?

Reading

2 Read the checklist. Then, mark the following statements as true (T) or false (F).

1 __ When an electronic device malfunctions, take it apart immediately.

2 __ If the display is scrambled, the problem is a bad connection.

3 __ Tapping on a device can help you figure out what's wrong with it.

Vocabulary

3 Match the words (1-8) with the definitions (A-H).

1 __ activity
2 __ warm up
3 __ display
4 __ scramble
5 __ hiss
6 __ dead
7 __ eliminate
8 __ malfunctioning

A to mix up
B not working correctly
C to let a machine run after starting it
D an s-like sound
E not working at all
F movement or action
G the screen on an electronic device
H to take something away so it is not considered

4 Read the sentence pair. Choose where the words best fit the blanks.

1 **hum / apart**

A When she turned the TV on, she heard a low ______________.

B After the DVD player broke, he took it ______________.

2 **remote control / external**

A Look at the ______________ parts before looking at the inside.

B Use the ______________ to turn on the television.

3 **tap / eliminate**

A Just ______________ the case lightly.

B The process will help you ______________ some choices.

5 Listen and read the checklist again. How can you check a malfunctioning device?

Listening

6 Listen to a conversation between two techs. Choose the correct answers.

1 Which of the following is NOT mentioned in the conversation?

A the reason for the external evaluation

B the noise the radio is making

C the location of the problem

D the repairs needed to fix the radio

2 What does the woman suggest checking first?

A the inside of the radio

B whether the radio hums

C whether the radio is dead

D the radio's power supply

7 Listen again and complete the conversation.

Tech 1: Hey, Bill. Hang on a minute. What are you doing?

Tech 2: Oh, hi Janice. I'm just taking this **1** ______ ______. I need to find out what's wrong with it.

Tech 1: Did you do an **2** ______ ______ first?

Tech 2: No. Do I need to?

Tech 1: You should. Sometimes you can tell what's wrong from the outside. It's easier and it **3** ______ ______.

Tech 2: Okay. What should I check first?

Tech 1: **4** ______ ______ ______. Does it work at all?

Tech 2: It does. It's not totally dead, there's a **5** ______ ______. Do you hear it?

Tech 1: Yeah ... I hear it.

Tech 2: What does that mean?

Tech 1: It means there's probably a problem with the **6** ______ ______.

Speaking

8 With a partner, act out the roles below based on Task 7. Then switch roles.

USE LANGUAGE SUCH AS:

Hang on a minute ...

You need ...

That means ...

Student A: You are an experienced electronics technician. Talk to Student B about:

- doing an external evaluation
- the first thing to check
- where the problem is located

Student B: You are a new electronics technician. Talk to Student A about evaluating the device.

Writing

9 Use the checklist and the conversation from Task 8 to fill out the instruction sheet

Instruction sheet for

Evaluating malfunctioning devices

DO NOT ______________________.

Instead, do an external evaluation first.

Ask yourself the following questions about the device:

1 ______________________

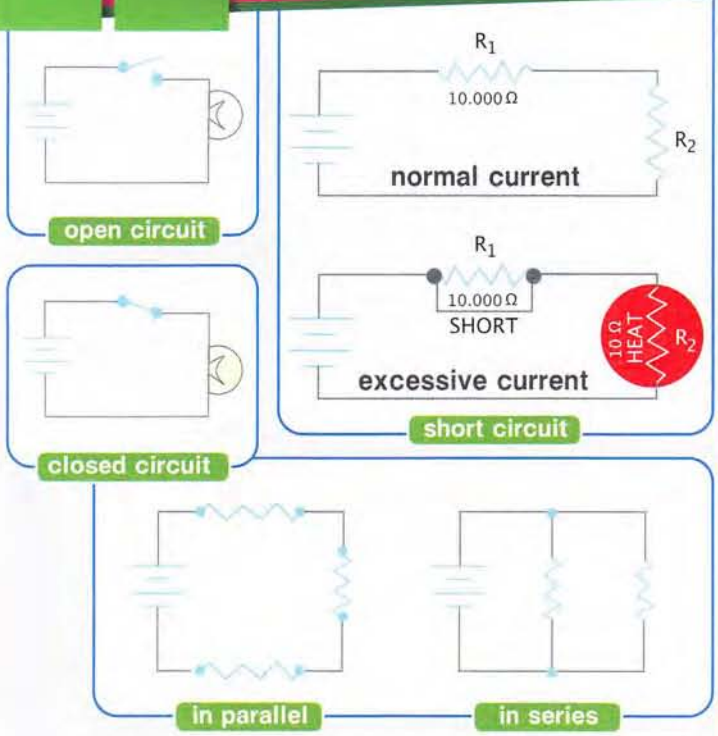
2 ______________________

3 ______________________

4 ______________________

5 ______________________

4 Circuits



Class EE151

Electronic **Circuits**

Lecturer:	Professor Andrew Moore
Lectures:	Monday-Wednesday-Friday, 10am-10:50am
Prerequisites:	This is a level 1 course. No prior background knowledge is needed.
Credits:	3 units, letter grade only

Course Description

This course offers an introduction to electronics, focusing on circuit operations

- Learn about current **origin** and circuit **component** functions
- Learn about **closed** and **open** circuit loops and the different **legs** of a circuit.
- Discover how circuits work **in parallel** and **in series**.
- Understand how electrical voltage is **rectified** for home use. Learn about the role of **reservoirs**.
- Explore the causes of **short circuits** and how to deal with **shorted** equipment.
- Gain hands-on experience. Learn how to **wire** a circuit and do basic repairs.
- Take apart electronics equipment. Examine **active elements** and analyze **stages**.

Grading

Homework = **15%**. Penalties apply to students who turn in homework late.
Midterm exam and weekly quizzes = **30%**
Final exam = **55%**

Get ready!

1 Before you read the passage, talk about these questions.

1 What is the opposite of a closed circuit?
2 What is one problem that can affect circuits?

Reading

2 Read the course description. Then, choose the correct answers.

1 What is the purpose of the passage?
  A to outline the course content
  B to announce an exam
  C to describe course levels
  D to introduce a professor

2 What will students NOT learn in this class?
  A the reasons that short circuits happen
  B the importance of reservoirs
  C the correct way to wire a circuit
  D the circuit operations in a home

3 What kinds of hands-on experience do students receive?
  A opening and closing circuit loops
  B creating a series of parallel circuits
  C labeling electronics' active elements
  D making repairs to damaged circuits

Vocabulary

3 Match the words (1-8) with the definitions (A-H).

1 __ closed	**5** __ open
2 __ in parallel	**6** __ origin
3 __ in series	**7** __ shorted
4 __ leg	**8** __ wire

A a section of an electrical circuit
B stopping current from traveling from one end of the power source to the other.
C to connect long, thin metal threads inside a piece of electrical equipment
D when several components are connected across the power source's two terminals
E the place where current comes from
F causing current to skip over part of a circuit and flow to the other end of the power source
G allowing current to travel from one end of the power source to the other
H when current has to pass through one circuit component before it can pass through any others

4 **Write a word that is similar in meaning to the underlined part.**

1 The technician repaired the <u>part of the electronics product that does one job</u>. _ _ a g _
2 The battery is a(n) <u>part of an electronics product able to make energy</u>. _ c _ i _ e e _ _ m _ _ t
3 There were several <u>elements in a circuit</u> such as resistors and capacitors. _ _ m _ o _ _ n _ s
4 As a result of the <u>current skipping over part of the circuit</u>, the equipment failed. _ h _ r _ _ _ r _ u _ t
5 The technician used the <u>device that stores energy</u> to keep the voltage even. _ _ s e _ v o _ r
6 The current was <u>changed into one polarity</u> so it could be used in people's homes. r e _ t _ _ i _ d

5 **Listen and read the course description again. What is the purpose of the course?**

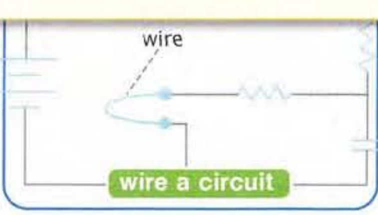
Listening

6 **Listen to a conversation between two students. Mark the following statements as true (T) or false (F).**

1 __ The woman has worked on short circuits before
2 __ There is a gap in the circuit.
3 __ They will try to replace a wire.

7 **Listen again and complete the conversation.**

Student 1: So, I guess we're **1** ______ ______ this week. I'm Andrea.
Student 2: Nice to meet you. My name's Mark. Have you ever dealt with **2** ______ ______ before?
Student 1: No, but it sounds fairly **3** ______. We just need to figure out why the circuit failed.
Student 2: **4** ______ ______ ______ that the circuit is broken in some way?
Student 1: I don't see the problem, but the circuit is definitely **5** ______.
Student 2: Well something caused the current to **6** ______ ______ ______ of the circuit.
Student 1: It looks like one of the wires might be the problem.



wire a circuit


circuit

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

Have you ever ...
It looks like ...
I think we ...

Student A: You are a student in an electronics class. Talk to Student B about:
- electronics experience
- the cause of the short circuit
- how to repair the circuit

Student B: You are also a student. Talk to Student A about fixing the short circuit.

Writing

9 **Use the course description and the conversation from Task 8 to fill out the student's notes.**

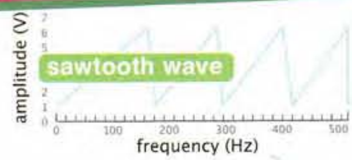
Short Circuit Notes

Problem: ______________________

Assessment: ______________________
____

Solution: ______________________
____

5 Signals

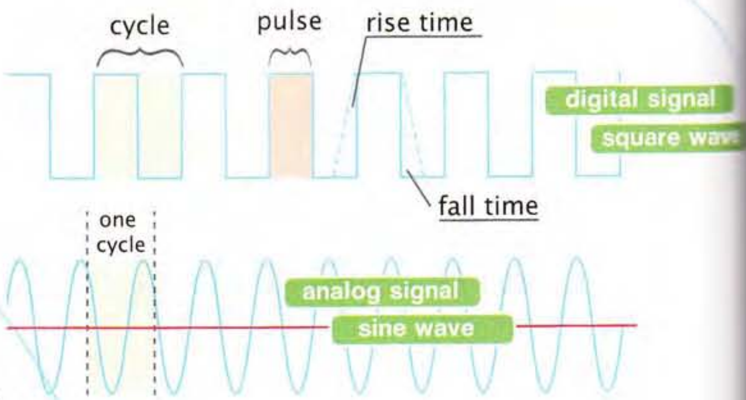


Get ready!

1 Before you read the passage, talk about these questions.

1 What are some types of signals?

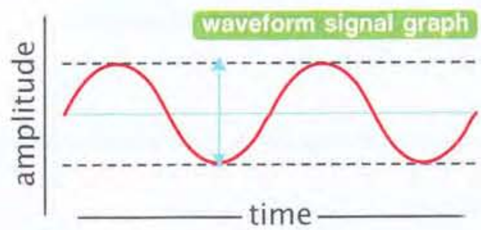
2 What are some types of waves?

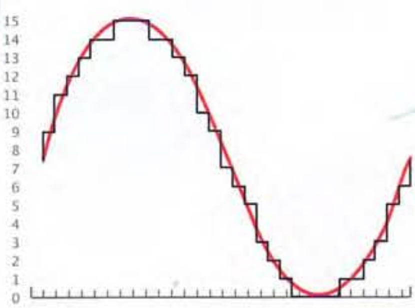


Electronic Signals

An electronic **signal** is a signal that carries information between two pieces of electronic equipment. Signals can be **analog** or **digital**. Analog signals alter the voltage to create a pattern that is similar to the data being sent. Digital signals are based on binary code. Digital signals are popular because they are easy to track and to store. Consequently, analog signals are sometimes turned into digital ones. Electronic circuits use an **analog-to-digital** converter to achieve this. A **waveform** is a signal, as represented on a graph. Graphs are often used in electronics. They can show information like the **amplitude**, **frequency** or **phase relationship** of a wave, and **cycles**. There are several different types of waves: **square waves**, **sine waves**, and **sawtooth waves**. These waves generate **harmonic energy** and other electromagnetic radiation. Each wave forms a different shape on a graph.

Time is another variable that is often recorded. Time is used to calculate **duty cycles**, **fall times** and **rise times**.





Reading

2 Read the textbook excerpt. Then, mark the following statements as true (T) or false (F).

1 __ Digital signals are often converted to analog ones.

2 __ A waveform is a signal that is shown on a graph.

3 __ Time is important when calculating harmonic energy.

Vocabulary

3 Read the sentence and choose the correct word.

1 A(n) **analog / digital** signal is based on binary code.

2 The student learned that the **sawtooth wave / frequency** is the number of cycles that take place during one second.

3 A **cycle / fall time** is one repetition of a waveform.

4 The **sawtooth wave / amplitude** gets its name from its distinctive shape.

5 The technician measured the **signal / fall time** from ninety to ten percent.

6 A(n) **analog / digital** signal alters the voltage to create a pattern.

7 **Amplitude / Cycle** is used to measure the strength of an electrical wave.

8 A **frequency / signal** transfers data between electrical equipment.

4 **Fill in the blanks with the correct words and phrases:** *analog-to-digital converter, harmonic energy, duty cycle, phase relationship, waveform, rise time, sine wave, square wave.*

1 The ______________ is the amount of time it takes for the transition to move from ten to ninety percent of its final height.
2 A ______________ is a signal as it appears on a graph.
3 A ______________ is a smooth wave with a pure tone.
4 A ______________ is made by turning a signal on and off repeatedly.
5 A ______________ is the percentage of time spent in the "on" state versus the "off" state.
6 The ______________ compares two signals and is measured in degrees.
7 ______________ is sound made at multiples of the same frequency as a base sound.
8 The technician used the ______________ to change analog information into digital information.

5 **Listen and read the textbook excerpt again. What are the advantages of digital signals over analog ones?**

Listening

6 **Listen to a conversation between an experienced tech and an apprentice. Choose the correct answers.**

1 What is the purpose of the conversation?
  A to compare oscilloscopes
  B to explain types of wave
  C to report dropped lines
  D to record signal patterns

2 What kind of lines does a sawtooth wave have?
  A peaked and downwards
  B horizontal and square
  C smooth and flowing
  D angled and vertical

7 **Listen again and complete the conversation.**

Exper. Tech: So, have you ever used an **1** ______ before?
Apprentice: Yes, I have. But I'm not familiar with this model.
Exper. Tech: No problem. Today, we're going to use the oscilloscope to look at **2** ______.
Apprentice: Okay.
Exper. Tech: Do you know how to tell the **3** ______ ______ of waves apart?
Apprentice: I look at the shape, right? I mean both the **4** ______ ______ and the sawtooth wave have different rise and fall times.
Exper. Tech: Very good. And unlike the sawtooth and square waves, the **5** ______ ______ forms a smooth, flowing signal.
Apprentice: Got it. How did the sawtooth wave get its name?
Exper. Tech: Well, the sawtooth wave rises **6** ______ ______ ______.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

Today we're ...
Do you know how ...
What's the difference ...

Student A: You are an experienced tech. Talk to Student B about:
- the oscilloscope
- how to tell waves apart
- the sawtooth wave

Student B: You are an apprentice. Talk to Student A about waves.

Writing

9 **Use the textbook excerpt and the conversation from Task 8 to fill out the apprentice's notes.**

Different types of waves

Sine waves - ______
____
____

Sawtooth waves - ______
____
____

Square waves - ______
____
____
____

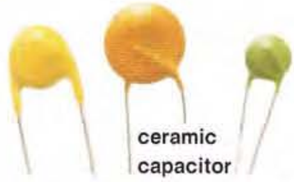
6 Capacitors

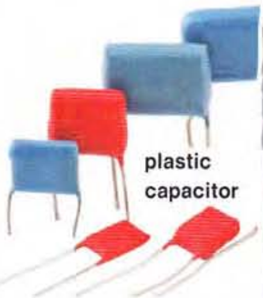
Get ready!

1 Before you read the passage, talk about these questions.

1 What are some types of capacitors?

2 What is one factor to consider when deciding which capacitor to use?





SIMBA
ELECTRONICS

AVC 299303. Ceramic disc capacitor. $0.69/unit
Non-polarized multilayer **ceramic capacitor**.
Flame-retardant. Typically used for coupling, and bypass applications.
Capacitance: 0.068 µf (micro**farad**)
Voltage **rating**: 50V
Operating temperature **range**: +10°C to +85°C

AVP 345005. **Plastic** (mylar) **capacitor**. $0.90/unit
Non-polarized polyester film (mylar) **insulator** and metal **plates** encased within a hard epoxy coating. Coating protects against moisture. Designed for use in general purpose DC applications.
Capacity: 0.0047 µf (microfarad)
Voltage rating: 100V
Operating temperature range: -67°F to 185°F

AVE 304050. **Electrolytic capacitor**. $0.39/unit
Aluminum capacitors designed for applications needing high capacitance, low cost, and very small size such as in personal computers and medical electronics.
Capacitance : 2.2 µf (microfarad)
Voltage rating: 50V
Operating temperature range: -40°F to 185°F

All of our capacitors contain **marks** indicating, at minimum, their capacitance.
Check out our **tantalum capacitors** and **trimmer capacitors** on the next page!

Reading

2 Read the catalog page. Then, mark the following statements as true (T) or false (F).

1 __ The electrolytic capacitors can be used in laptops.

2 __ The plastic capacitor is designed to resist wetness.

3 __ The ceramic capacitor has the highest capacitance rating.

Vocabulary

3 Read the sentence pair. Choose where the words best fit the blanks.

1 **electrolytic capacitor / trimmer capacitor**

A Use a(n) ________________ when you have limited space.

B The ________________ can adjust the frequency of an oscillator.

2 **capacitor / farad**

A Check the ________________ rating for the device.

B The ________________ stores the electric current.

3 **ceramic capacitor / tantalum capacitor**

A This radio circuit needs a new ________________.

B If you need one with a filtering function, use a ________________.

4 Fill in the blanks with the correct words and phrases from the word bank.

word BANK

insulator mark plastic capacitor
plate range rating

1 Tell me the capacitor's temperature ________________.

2 What's the voltage ________________?

3 I can't read the ________________ on this item.

4 Use a(n) ________________ if stability is important.

5 Ceramic is an excellent ________________.

6 This capacitor's metal ________________ is broken.

5 Listen and read the catalog page again. Which capacitor would be best for an electronic device used in a damp area?

Listening

6 Listen to a conversation between a store clerk and a customer. Choose the correct answers.

1 What is the main purpose of the conversation?
  - A to confirm an order
  - B to inquire about a promotion
  - C to order products
  - D to request a repair

2 What can you infer about AVE 304050?
  - A Its capacity is two or more microfarads.
  - B It contains a plastic insulator.
  - C It is sold in packages of three units.
  - D It offers protection against humidity.

7 Listen again and complete the conversation.

Clerk: Thank you for calling Simba Electronics. **1** _______ _______ _______ help you?

Customer: I need some **2** _______, but I'm not sure which model to get.

Clerk: Well, we currently **3** _______ _______ _______ _______ our AVP 345005, which are mylar, very water resistant.

Customer: Actually, I'm repairing a **4** _______ _______ for a remote control, so it doesn't need to be water resistant.

Clerk: No problem. What **5** _______ do you need?

Customer: It has to handle 50 volts and at least **6** _______ _______.

Speaking

8 With a partner, act out the roles below based on Task 7. Then switch roles.

USE LANGUAGE SUCH AS:

I need ...

We have ...

They cost ...

Student A: You are a store clerk. Talk to Student B about:
- what he or she needs
- your recommendations
- the quantity and price

Student B: You are a customer. Talk to Student A about what product you should buy.

Writing

9 Use the catalog page and the conversation from Task 8 to fill out the product order form.

Simba Electronics

Product Order Form

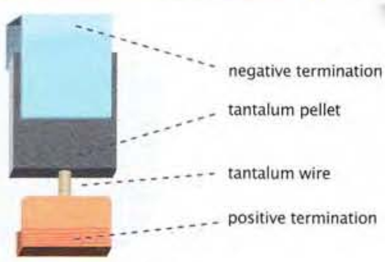
Product description: ______________________

____

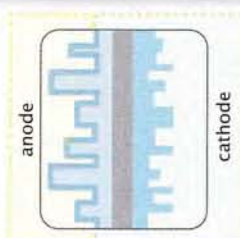
Quantity: ______________________

Price/unit: ______________________

trimmer capacitor

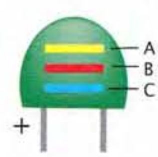


tantalum capacitor



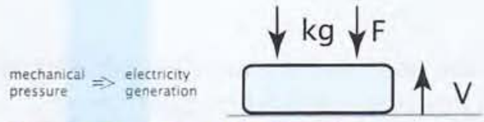
electrolytic capacitor

capacitance marks



7 Crystals and resonators

A **crystal** consists of a **slice** of **quartz** sandwiched between a pair of electrode plates **encased** in a metal covering. It has two **leads** protruding out from underneath it. A ceramic **resonator** has a similar basic structure, but with important differences. A **ceramic slab** is found between the two electrode plates. It is covered in plastic and has two or three leads.

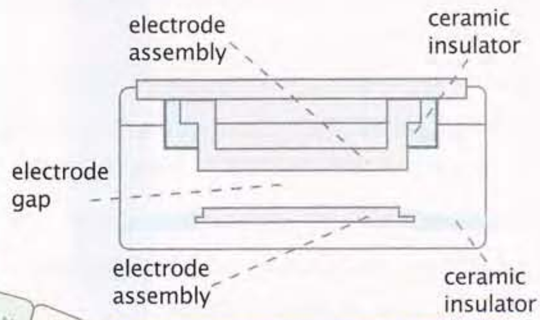


direct piezoelectric effect

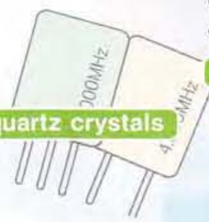
[Crystals and Resonators]

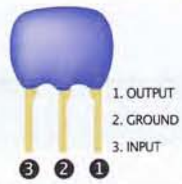
Quartz and ceramic, like some other materials, will **vibrate** when electricity is applied to them. Conversely, they will **generate** electricity when mechanical pressure is applied. This is called the **piezoelectric effect**. Both quartz crystals and ceramic resonators are found in many electronic devices. They are used in frequency generators, timing circuits, and **filters**. They are found in TVs, VCRs, and computers. Quartz crystals are more accurate and stable. Ceramic resonators are generally smaller, cheaper, and used when accuracy is not as important.

reverse piezoelectric effect



ceramic slab - electrode plates


quartz crystals



ceramic resonator

Get ready!

1 Before you read the passage, talk about these questions.

1 What type of rock is used in crystal resonators?
2 How is a resonator connected to a circuit board?

Reading

2 Read the web tutorial. Then, choose the correct answers.

1 What is the main idea of the tutorial?
- **A** a description of two devices
- **B** an explanation of oscillation
- **C** how materials produce electricity
- **D** a comparison of two materials

2 Which of the following is NOT true of ceramic resonators?
- **A** They have plastic coverings.
- **B** They are used for timing elements.
- **C** They have three electrode plates.
- **D** They can produce electricity.

3 What can be inferred about quartz crystals?
- **A** They cannot touch plastic surfaces.
- **B** They cost more than ceramic resonators.
- **C** They are preferred in larger radios.
- **D** They move faster than ceramic resonators.

Vocabulary

3 Choose the sentence that uses the underlined part correctly.

1 **A** Warm air will often become a <u>crystal</u>.
B Check the frequency of the <u>resonator</u>.

2 **A** She replaced the computer's <u>slice</u>.
B Plants <u>generate</u> food from sunlight.

3 **A** Use a <u>filter</u> to remove the sand from the water.
B Pour the <u>ceramic</u> into the bowl.

4 **A** The TV was <u>encased</u> with batteries.
B The house was built on concrete <u>slabs</u>.

5 **A** This device has one broken <u>lead</u>.
B The <u>piezoelectric effect</u> creates metal.

6 **A** <u>Quartz</u> is often found in watches.
B When an engine <u>vibrates</u>, it gets cold.

4 **Read the sentence and choose the correct word.**

1 The device was **encased / quartz** in plastic.
2 **Ceramic / Slab** is a poor conductor of electricity.
3 A **crystal / resonator** might be found in a laptop.
4 The **filter / piezoelectric effect** creates voltage.
5 The device will **generate / vibrate** when electricity is applied.
6 Place a **lead / slice** of the material between the electrodes.

5 **Listen and read the web tutorial again. Do crystals and resonators have the same number of leads?**

Listening

6 **Listen to a conversation between a customer and a tech. Mark the following statements as true (T) or false (F).**

1 __ The cell phone's clock is too slow.
2 __ The customer replaced the phone's battery.
3 __ The tech will install a new clock in the phone.

7 **Listen again and complete the conversation.**

Customer: Well, I accidentally dropped my cell phone and the clock function is **1**______ ______ ______.

Tech: Have you checked the **2**______?

Customer: Yes, I got a **3**______ ______ ______. Everything else seems to be working fine, but the clock is frozen at 12:03, the time when I dropped it.

Tech: My guess is that the crystal **4**______ ______ ______ ______ cracked when you dropped the phone.

Customer: Is that serious?

Tech: **5**______ ______, I can fix it.

Customer: Thank goodness. What will you do to it?

Tech: I'll have to open it up, then remove the **6**______ ______ and replace it with a new one.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

My guess is that ...
Is that serious ...
I'll have it working ... by ...

Student A: You are a tech in an electronics store. Talk to Student B about:
- his or her problem
- a possible solution/repair
- when the solution/repair will be complete

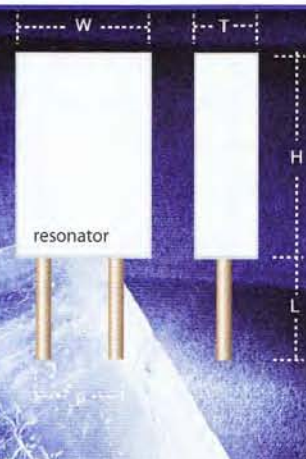
Student B: You are a customer. Talk to Student A about your broken device.

Writing

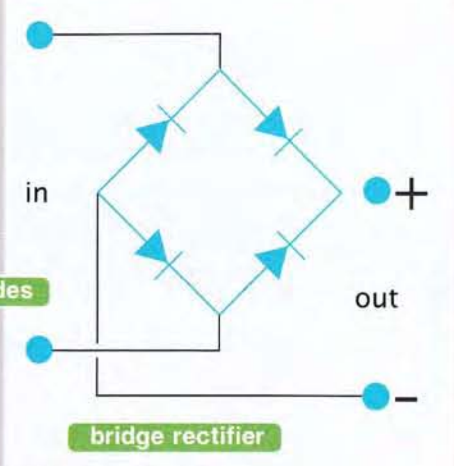
9 **Use the web tutorial and the conversation from Task 8 to fill out the repair ticket.**

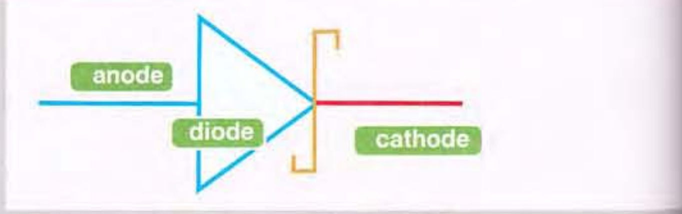
JD Electronics Repair

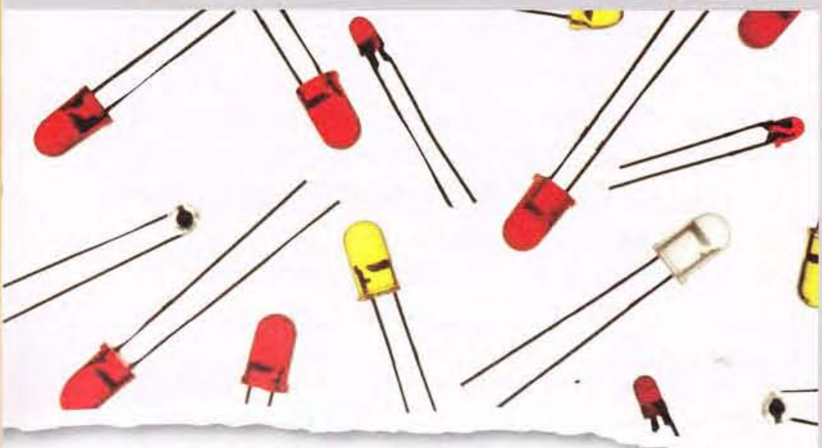
Repair Ticket Number: 299040
Customer name: ______________________
What is the problem? ______________________
____
Repair procedure: ______________________
____



8 Diodes







A **diode** is a one-way **valve** that allows current to flow through it. Each diode has a **cathode** and an **anode** for allowing current to pass in the right direction. The cathode can be found by locating the **band** on the diode.
Larger diodes are found in power supplies and are called **rectifiers**. Several types of rectifiers are common, including a **bridge rectifier** and a **double rectifier**.
It is common to see the **peak inverse voltage (PIV)** indicated. The PIV is important because exceeding this **maximum** can destroy the diode. Monitoring the **pulse** is also important, in order to notice any changes in a current.
Both smaller diodes and rectifiers are commonly found in electrical items. Diodes assist in the function of these items by directing voltage. They can also be used as **biasing elements** for transistor and LED panels. A **light-emitting diode** emits light on the control panels of most modern electronics.

Get ready!

1 Before you read the passage, talk about these questions.

1 Which part of a diode does electricity flow into?

2 What kind of diode is often used in remote controls?

Reading

2 Read the textbook excerpt. Then, choose the correct answers.

1 What is the purpose of this passage?
- A to describe different types of diodes
- B to explain how to measure currents
- C to show the uses of LEDs in electronics
- D to discuss when to use transistors

2 Which of the following is NOT a part of a diode?
- A anode
- B band
- C cathode
- D bridge

3 What do diodes help do?
- A maximize pulse
- B direct voltage
- C destroy current
- D control light

Vocabulary

3 Match the words (1-8) with the definitions (A-H).

1 __ valve
2 __ rectifier
3 __ anode
4 __ cathode
5 __ bridge rectifier
6 __ double rectifier
7 __ light-emitting diode
8 __ peak inverse voltage

- A the highest value of the input voltage that a diode can handle before allowing it to pass
- B the place where current flows in from the outside
- C the place where current flows out from the inside
- D four rectifiers arranged with a diamond-like configuration
- E emits light when a current passes through it
- F a device that controls the flow of liquid, gas, or other substances
- G a large diode that forces an alternating current to become direct
- H two rectifiers that share one terminal

4 **Read the sentence and choose the correct word.**

1 It was easy to find the cathode by locating the **pulse / band**.

2 The **pulse / biasing element** of the current made the electrician think that something was wrong.

3 The amount of current reached its **rectifier / maximum** and the fuse blew.

4 Mary used the diode as a **biasing element / maximum** to assist in the function of her transistor.

5 **Listen and read the textbook excerpt again. Can a current flow both ways through a diode?**

Listening

6 **Listen to a conversation between two students. Mark the following statements as true (T) or false (F).**

1 __ The woman thinks that the diode might be causing the radio not to work.

2 __ The man suggests finding a part at the hardware store.

3 __ The students decide the part is a bridge rectifier.

7 **Listen again and complete the conversation.**

Student 2: Maybe it's the diode?

Student 1: Maybe. **1** ______ ______ ______ ______ happened to it?

Student 2: I'm not sure, but they can die if the peak inverse voltage **2** ______ ______ ______.

Student 1: Okay, let's look up a **3** ______ ______ online, just in case.

Student 2: Alright, would it be a **4** ______ ______?

Student 1: I don't think so. It's not in the **5** ______ ______ ______.

Student 2: Okay, can you tell me **6** ______ ______ ______? It should be located near the band.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

Maybe it's ...

What do you think ...

I think that ...

Student A: You are a student. Talk to Student B about:

- a device that is not working
- Why the part is not working
- What the part number is

Student B: You are a student. Talk to Student A about a device that is not working.

Writing

9 **Use the textbook excerpt and the conversation from Task 8 to fill out a troubleshooting guide for a remote control.**

Troubleshooting **Guide** for your **Remote Control**

If your remote control stops working, it could be ...

____

____

This can happen if ...

____

____

For a replacement part, ...

____

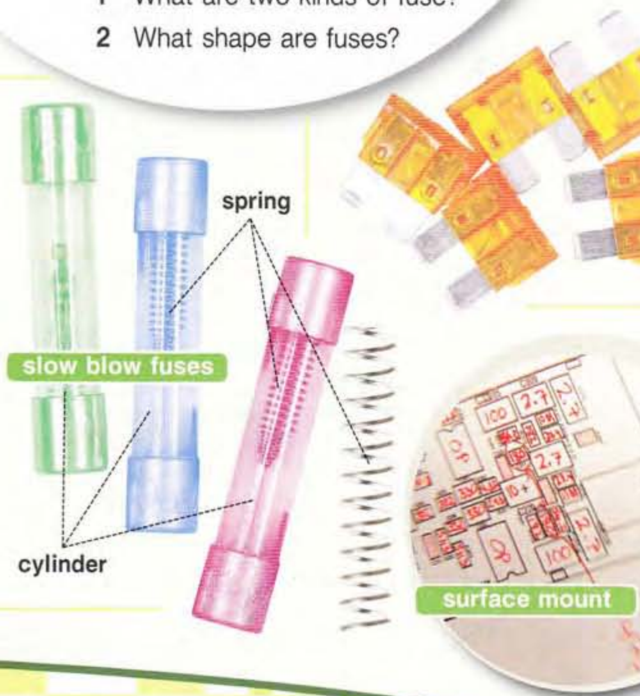
____

DVD Player Manual

Get ready!

1 Before you read the passage, talk about these questions.

1 What are two kinds of fuse?
2 What shape are fuses?



The **fuse** is important; it **protects** a circuit against current surges. If a fuse **blows**, that means the current rating has been **exceeded**. Follow these directions to replace the blown fuse. Doing this yourself can save you money.

First, make sure that the DVD player is unplugged. Now you will need to locate the fuse. Open the DVD player by removing the cover. The fuse will be on the **hot side** of the AC line. The hot side can be identified by a black or red wire.

The fuse is shaped like a **cylinder** and has a **coil** wire inside. It also has a **holder** that might be flat and **rectangular**. The holder attaches to the device with metal **springs**.

Once you find the fuse, replace it with another one just like it. The replacement fuse could be a fast-blow or **slow-blow fuse**. **Surface-mount** fuses can attach to circuit boards. Place the new fuse where the old one was.

Reading

2 Read the instructions. Then, choose the correct answers.

1 What is the main idea of this passage?
  A building a fuse holder
  B finding the coil in a fuse
  C replacing a blown fuse
  D attaching a spring to a fuse

2 According to the manual, what is the first thing that should be done?
  A find the fuse in the DVD player
  B make sure that the player is unplugged
  C use a slow-blow fuse as a replacement
  D attach a holder to the player

3 Which of the following is NOT discussed in the manual?
  A where the fuse is located
  B what a surface-mount is used for
  C what to use as a replacement fuse
  D why the fuse is on the hot side

Vocabulary

3 Match the words (1-8) with the definitions (A-H).

1 __ coil
2 __ spring
3 __ holder
4 __ hot side
5 __ rectangular
6 __ cylinder
7 __ slow-blow fuse
8 __ surface-mount

A an object with circular ends and straight sides
B describes an object that has four right angles
C something that contains a fuse
D a strip of steel that recovers its shape when compressed
E this attaches a fuse to the flat surface of an object
F a strip of metal that is wound like a spiral
G where wires that are not grounded are located
H this demands a high start-up current and has a time-delay

4 **Read the sentence and choose the correct word.**

1 The radio **blew / protected** a fuse which made it stop working.

2 The current was **exceeded / protected** and the fuse was blown.

3 The fuse can **protect / exceed** the device from too much current.

5 **Listen and read the instructions again. How is the holder attached to the DVD player?**

Listening

6 **Listen to a conversation between a customer and an employee. Mark the following statements as true (T) or false (F).**

1 __ The woman wants to order a DVD player.

2 __ The man suggests a slow-blow fuse.

3 __ The woman decides to find a replacement fuse at a store.

7 **Listen again and complete the conversation.**

Employee: Okay, **1** ______ ______ ______ the brand and model name on the player.

Customer: Yes, it's a Star, model XYZ1.

Employee: Thanks. You'll need to **2** ______ ______ ______ ______ from us to replace it.

Customer: Can I just get a regular fuse **3** ______ ______ ______ ______?

Employee: Well, you can look, but you have to make sure that it's **4** ______ ______ ______ rating.

Customer: **5** ______ ______ ______ describe the right fuse in more detail for me?

Employee: Yes, it needs to be a **6** ______ - ______ ______ and the same small size as the old one.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

When did you ...

Could you give me ...

Can I ...

Student A: You are an employee. Talk to Student B about:

- when he or she bought the TV.
- the model of the TV.
- what type of fuse he or she needs

Student B: You are a customer. Talk to Student A about replacing the blown fuse in your TV.

Writing

9 **Use the instructions and the conversation from Task 8 to fill out a sample script for employees who answer the phone.**

Employee Phone Script

Employee: ______________________________

____

Customer: ______________________________

____

Employee: ______________________________

Customer: ______________________________

Employee: ______________________________

Customer: ______________________________

10 Chips (Integrated circuits)

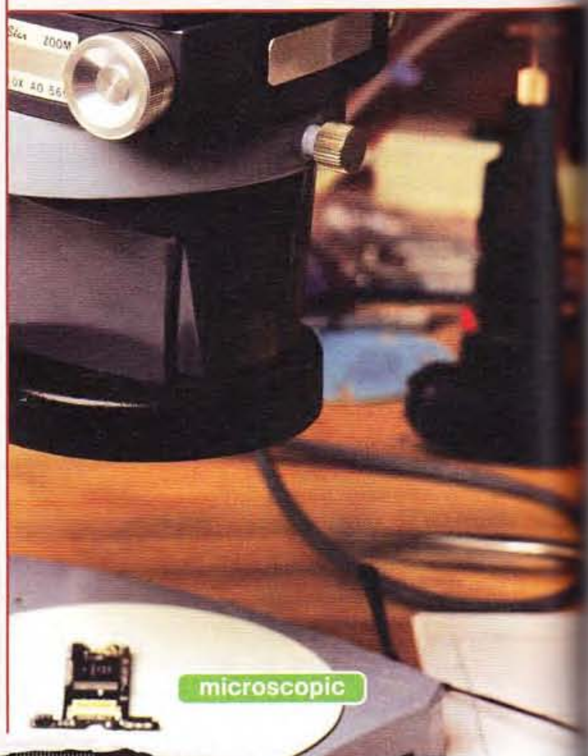
Millennium Electronics to Produce Smallest Microchip

December 14 - Millennium Electronics is announcing the development of the smallest **chip** on the market. This device will work similarly to the current **silicon** chips. The new chips will be **custom**-made to fit smaller electronic devices. They will be **microscopic** in size and work more efficiently.

Millennium electronics will first develop **small scale integrated chips (SSI)** and **large scale integrated chips (LSI)**. We will test their durability. We also want to ensure that they are not **defective**. Additionally, we will be producing smaller **fans** for the microchip.

Millennium Electronics is still in the planning stages of this project. Development on the chips will start within the next month. We hope to have them fully completed by November of next year.

If this chip performs, Millennium Electronics plans to rework other products. We will start by producing chips that contain more **transistors**. Millennium Electronics also wants to produce smaller **graphics cards**.

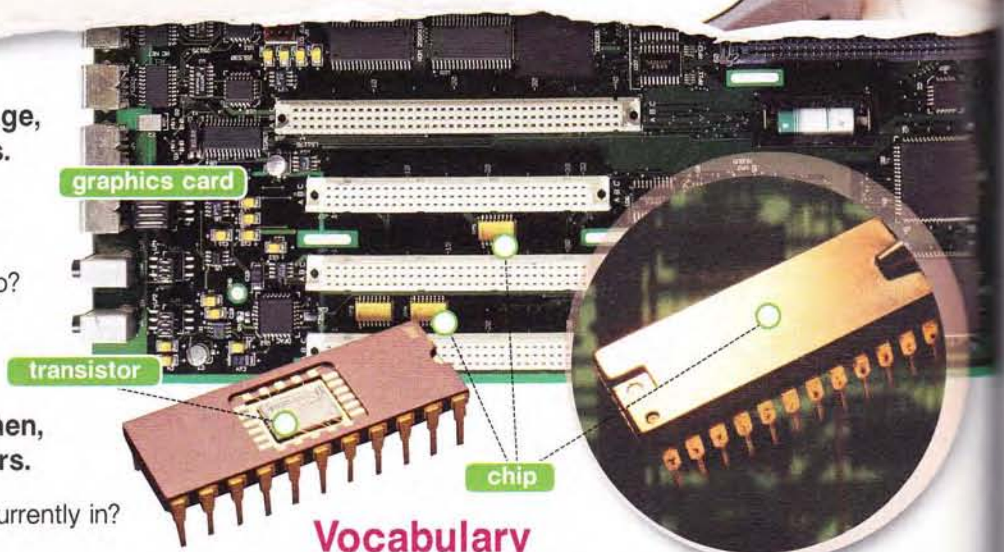


Get ready!

1 Before you read the passage, talk about these questions.

1 What is one type of chip?

2 What device is needed to closely examine a microchip?



Reading

2 Read the press release. Then, choose the correct answers.

1 What stage is the project currently in?

A the planning stage

B the production stage

C the development stage

D the testing stage

2 Which of the following is the company NOT planning on producing?

A fans

B graphics cards

C electronic devices

D microchips

3 How will the chip work differently than it does now?

A It will be faster.

B It will be smaller.

C It will be have more transistors.

D It will have better working fans.

Vocabulary

3 Match the words (1-7) with the definitions (A-G).

1 __ transistor

2 __ silicon

3 __ custom

4 __ SSI

5 __ chip

6 __ LSI

7 __ defective

A functions as a signal enhancer or a switch

B integrated circuit used in electronic devices

C contains thousands of semiconductors.

D a natural, non-metallic element

E specially designed for a certain purpose

F contains only a few semiconductors

G device that does not work properly

4 **Write a word that is similar in meaning to the underlined part.**

1 The computer's <u>circuit board that controls images</u> was not working properly.
g r _ p _ _ c _   c _ r _

2 He was unable to see the device's chip because it was <u>a size that was too small to be seen with the naked eye</u>.
m _ c r _ s _ o p _ c

3 The computer's <u>object that keeps the chip from overheating</u> broke.
f _ _

5 **Listen and read the press release again. Why are chips so widely used?**

Listening

6 **Listen to a conversation between an executive and a developer. Mark the following statements as true (T) or false (F).**

1 __ The woman is pleased with the work being done.
2 __ The man will be finished with the planning soon.
3 __ The man wants to make chips that work better than the others.

7 **Listen again and complete the conversation.**

Executive: Hi Mr. Sanders. How's the work on that new **1** ______ coming along?

Developer: It's going great. We're in phase 2 of the **2** ______ ______.

Executive: Good. I just wanted to say that you and your team did a **3** ______ ______ developing the concept.

Developer: Thank you. We worked really hard on it.

Executive: I can tell. You all **4** ______ a pat on the back for all your work.

Developer: Thank you. We're really trying to make this chip more durable and efficient than the ones we've been producing.

Executive: I'm sure they will be. When do you think you'll be **5** ______ planning?

Developer: We're hoping to finish within the **6** ______ ______ ______.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

How's the work on ... coming along?

I just wanted to say ...

When do you think ...

Student A: You are a company executive. Talk to Student B about:

- how the planning is coming
- his or her work on the project
- the next step in the project

Student B: You are a chip developer. Talk to Student A about your work on the project.

Writing

9 **Use the press release and the conversation from Task 8 to fill out the executive's notes regarding the project.**

Project Notes

Project: ______________________

Stage of development: ______________________

Next stage: ______________________

____

Additional notes: ______________________

____

____

11 Resistors

Get ready!

1 Before you read the passage, talk about these questions.

1 What are some types of resistor?

2 How is a resistor's resistance identified?

TCI

Electronics Repair

WORK ORDER

Customer #: 950044	Customer: Steven Prine	Phone: 354-0961

Work Performed

1 Tested MP3 player circuits. Found two **resistors** that did not **limit** current correctly. Earlier repair attempt appears to have **interchanged** the two resistors improperly. Both were damaged. Removed both and replaced with new **metal oxide resistors**. Tests indicate new resistors provide sufficient **opposition** to current.

2 Tested remote control device. Found one **carbon composition resistor** that did not **dissipate** sufficient heat. It was beginning to **disintegrate**. Although its numbers were no longer visible, the **color code** was still readable. Determined the correct tolerance number as **represented** by the colored bands. Replaced it with a **wire-wound resistor**. Remote control is now working properly.

Parts

Quantity	ID#/ Description	Cost	
2	G34/ metal oxide resistor	$5.50	
1	G30/ wire-wound resistor	$3.25	
Total		$8.75	

Charges

Parts		$8.75	
Labor		$17.50	
Total		$26.25	

Reading

2 Read the work order. Then, choose the correct answers.

1 What was removed from the MP3 player?

A resistors

B circuits

C metal oxide

D current

2 What information is NOT included on the work order?

A the quantity of parts replaced

B the name of the items worked on

C the price of labor performed

D the ID number of the employee

3 What can you infer about the remote control?

A It was improperly repaired in the past.

B It was not working correctly yesterday.

C It used to have wire-wound resistors.

D It was subjected to extreme cold.

Vocabulary

3 Match the words (1-5) with the definitions (A-E).

1 __ resistor

2 __ limit

3 __ interchange

4 __ disintegrate

5 __ dissipate

A to switch

B to break into pieces

C thing to limit current

D to spread outward

E to stop something

4 **Read the sentence pair. Choose where the words best fit the blanks.**

1 **color code / represent**

A The symbols on the diagram ______________ components.

B Use the ______________ to obtain the correct numbers.

2 **carbon composition resistor / opposition**

A Resistance is the ______________ to electrical current.

B Replace the ______________ in this circuit board.

3 **metal oxide resistor / wire-wound resistor**

A Use a ______________ if you need a tight tolerance.

B Don't put a ______________ in high-frequency circuits.

5 **Listen and read the work order again. How was the tolerance number found?**

Listening

6 **Listen to a conversation between an apprentice tech and a senior tech. Mark the following statements as true (T) or false (F).**

1 __ The apprentice tech wants to replace a defective resistor.

2 __ The tech must use a screwdriver.

3 __ The color code is visible on the defective resistor.

7 **Listen again and complete the conversation.**

Apprentice Tech:	Could you explain how to replace a **1** ______ ______?
Senior Tech:	Sure. It's not that hard to do. The **2** ______ ______ is to test the circuit to find which resistor or resistors are bad.
Apprentice Tech:	Okay. I **3** ______ ______ ______.
Senior Tech:	So did you identify any **4** ______ ______?
Apprentice Tech:	Yes. **5** ______ ______ ______. But I haven't removed it yet.
Senior Tech:	Good. Are the **6** ______ ______ still visible?

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

Can you help ...

I think ...

I'll do it ...

Student A: You are a senior tech. Talk to Student B about:

- changing a resistor
- identifying the problem
- the solution

Student B: You are an apprentice tech. Talk to Student A about changing a resistor.

Writing

9 **Use the work order and the conversation from Task 8 to fill out the repair work order.**

ITC Radio Repair

4 5 6 7 8 9

Work order number: ______________

Customer name: ______________

Work performed: ______________

____

____

____

____

____

____

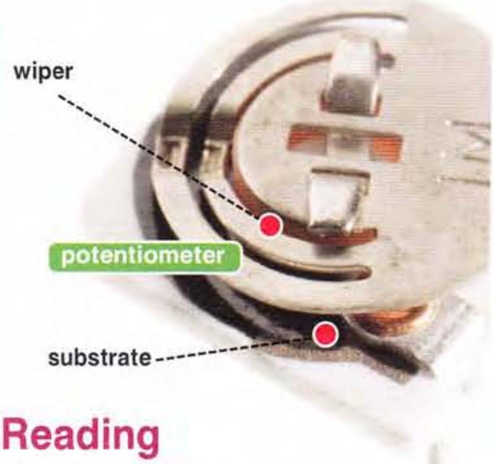
12 Potentiometers

Get ready!

1 Before you read the passage, talk about these questions.

1 What are some parts of a potentiometer?

2 How is a potentiometer's resistance value graphed?



Reading

2 Read the webpage. Then, mark the following statements as true (T) or false (F).

1 __ Product AC1930 consists of two pots that are ganged.

2 __ The trimpot contains some parts that are made of ceramic.

3 __ Product GC1930 can be used to manually control volume.

Vocabulary

3 Match the words (1-6) with the definitions (A-F).

1 __ gang

2 __ isolated

3 __ rotary

4 __ potentiometer

5 __ shaft

6 __ substrate

A to group together

B being able to turn

C being alone

D a base layer

E a metal rod that turns

F a variable resistor

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YAZZIE'S AUDIO

ELECTRONIC COMPONENTS

25K and 50K ohm Dual Ganged **Potentiometer** (pot)

Product ID Number: AC1930 - Manufacturer: KMT

Product Description: Two-part **shaft**. Each part moves independently and has a separate **wiper**. Smaller part connects to 50K **audio taper pot**. Larger part connects to 25K **log taper pot**.

Uses: Use in a variety of stereo applications (i.e. volume control). Can be used to replace **rheostats** in older audio systems. 50K and 25K pots can be **isolated** or **ganged** together to manage stereo audio channels.

Click here to see the **resistance curve**.

30K ohm 1/8" Square Cermet **Trimpot**

Product ID Number: GC1930 - Manufacturer: Ganzu

Product Description: Durable cermet construction consisting of a metallic resistance element attached to ceramic **substrate**. Three **terminals** attached to resistance element. **Rotary** shaft adjusts resistance.

Uses: Surface mount this **linear taper pot** in device interior or on printed circuit boards to adjust resistance.

Click here to see the resistance curve.

4 Fill in the blanks with the correct words and phrases from the word bank.

Word BANK

linear taper pot | log taper pot | resistance curve | rheostat | trim pot | wiper

1 There are two leads on the ______________.

2 You need a ______________ for volume control.

3 When you turn the knob, the ______________ moves.

4 Use a ______________ if you want resistance to change evenly.

5 Install a ______________ to adjust the internal circuits.

6 The ______________ shows how a pot's resistance changes.

5 Listen and read the webpage again. What can customers find out more information about?

Listening

6 Listen to a conversation between a customer and a manufacturer. Then, choose the correct answers.

1 What is the conversation mostly about?

A describing an audio system kit

B comparing different potentiometers

C discussing an assembly process

D ordering the correct product

2 What is the woman assembling?

A a potentiometer C an audio channel

B an audio system D a volume control knob

7 Listen again and complete the conversation.

Manufacturer: Good morning, you've reached Gamma Potentiometers.

Customer: Hi, I'm calling because I'm putting together **1** ______ ______ ______ from a kit. I need a pot to connect to a volume control knob. What would you recommend?

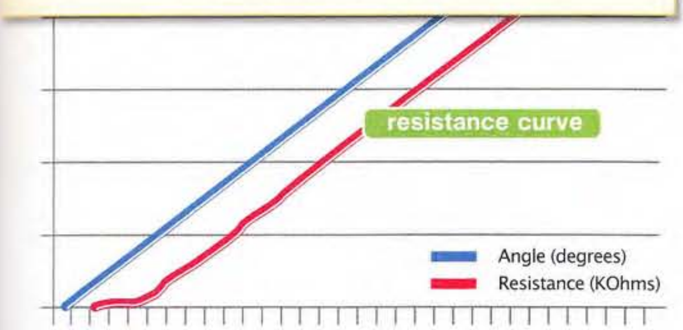
Manufacturer: Will it control one or two **2** ______ ______?

Customer: Two, I think. This is a **3** ______ ______.

Manufacturer: Definitely two then. So you want a dual-ganged **4** ______ ______.

Customer: That's **5** ______ ______ ______, but I wasn't sure. Which one do you think is the best for this job?

Manufacturer: How much **6** ______ do you need?



Speaking

8 With a partner, act out the roles below based on Task 7. Then switch roles.

USE LANGUAGE SUCH AS:

I need ... What would you recommend?

What are you using ...

I have ...

Student A: You are a manufacturer. Talk to Student B about:

- what he or she needs
- what specs are required
- what product you recommend

Student B: You are a customer. Talk to Student A about what product you need.

Writing

9 Use the webpage and the conversation from Task 8 to fill out the customer service survey.

Topton Potentiometers

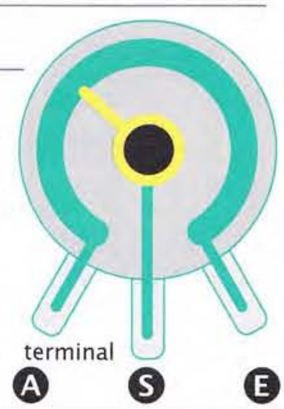
Customer Service Survey

Why did you contact Topton? ______

How would you rate our customer service?

❑ excellent ❑ good ❑ poor ❑ other

Please explain: ______



13 Relays and switches

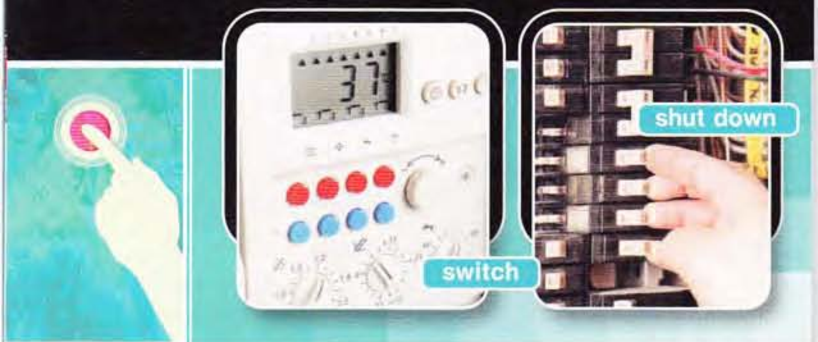
Get ready!

1 Before you read the passage, talk about these questions.

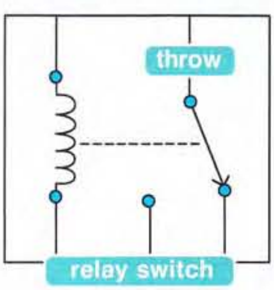
1 What is one kind of switch?

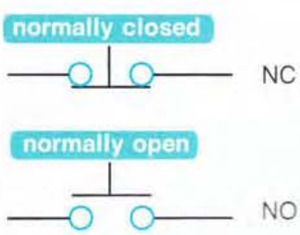
2 What are two throws a switch can have?

ELECTRONICS MONTHLY



There are a **variety** of different **switches** in the marketplace. However, each switch does the same job: it **controls** the **passage** of current. For instance, a **relay** is a kind of switch that lets a small current control a bigger current.
Switches can have several different **contacts**. In particular, rotary and slide switches often have many **poles**. Some contacts are **normally open**, which means that the circuit is **unconnected**. This stops the passage of current. Other contacts are **normally closed**. In such cases, the contacts connect, even when the switch is in the 'off' position. Each of these directions is known as a **throw**.
Switch failure can **shut down** even complicated electronics. Therefore, quality control is critical to the success of the switch production industry. Switches are a part of everyday life. They are inside everything from remote controls to phone jacks and circuit boards.





Reading

2 Read the trade magazine article. Then, mark the following statements as true (T) or false (F).

1 __ Switches control current in a circuit.

2 __ When contacts are normally closed, the circuit is unconnected.

3 __ Rotary and slide switches can have many poles.

Vocabulary

3 Match the words (1-6) with the definitions (A-F).

1 __ control
2 __ normally open
3 __ passage
4 __ relay
5 __ switch
6 __ throw

A the movement through, past, or over a location

B to make a machine work in the desired way

C a position that a switch can be in

D a device used to allow or stop the passage or current

E having contacts that do not touch when the switch is in the "off" position

F a switch that is controlled by another electrical circuit

4 Write a word that is similar in meaning to the underlined part.

1 The contacts are <u>touching, even when the switch is in the 'off' position</u>.
_ _ r _ a _ l _   c _ _ s _ d

2 After the switch failed, the electronics system <u>stopped working</u>. _ h _ t   _ o _ n

3 There were a <u>number of different types</u> of wires in the circuit. _ a _ _ e _ y

4 There were a lot of <u>sets of contacts</u> in the rotary switch. _ o l _ _

5 When the <u>device used to conduct current</u> closed, electricity passed through the circuit. _ _ n _ a _ t s

6 The wire was <u>not linked to the system</u>, so the circuit did not work. _ _ c o _ _ e _ t _ d

5 Listen and read the trade magazine article again. Why is quality control important?

Listening

6 Listen to a conversation between a tech and a customer. Choose the correct answers.

1 What is the conversation mostly about?
- **A** the role of switches
- **B** the repair schedule
- **C** a broken keyboard
- **D** calling a customer

2 What does a switch contact do?
- **A** completes a circuit
- **B** fixes a computer
- **C** corrodes a keyboard
- **D** measures time

7 Listen again and complete the conversation.

Customer: So, do you know what's wrong with my computer keyboard? It's an old one, but I really like it.

Tech: Well, there are several possibilities. I think the problem is probably a **1** ______ ______ ______.

Customer: Great. How quickly can you repair that? I really need my keyboard back **2** ______ ______ ______.

Tech: I can't **3** ______ the problem until I've examined the keyboard more thoroughly.

Customer: What kind of **4** ______ are we talking about?

Tech: I'll need to **5** ______ ______ ______ for forty-eight hours.

Customer: Can you fix it in that amount of time?

Tech: Yes, **6** ______ ______ ______ is the switch contact. If it's something more serious, I'll give you a call.

Speaking

8 With a partner, act out the roles below based on Task 7. Then switch roles.

USE LANGUAGE SUCH AS:

There are several ...

How quickly ...

Only a few ...

Student A: You are a customer at an electronics repair store. Talk to Student B about:
- the likely problem
- What needs to be done
- the repair timeframe

Student B: You are an electronics repair tech. Talk to Student A about fixing the phone jack.

Writing

9 Use the trade magazine article and the conversation from Task 8 to fill out the repair order.

Repair Order

Problem: ______________________________

____

Suspected cause: ______________________________

____

Action to take: ______________________________

____

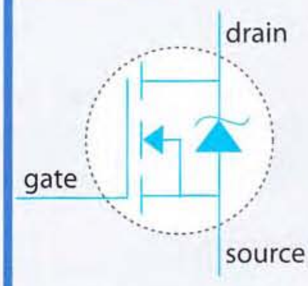
____

Timeframe: ______________________________

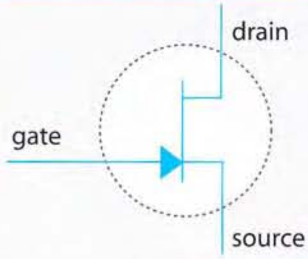
14 Transistors

WHAT DOES IT DO?

All About Transistors

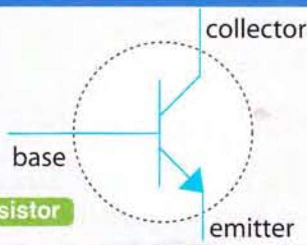


MOSFET transistor



junction field effect transistor (JFET)

A transistor is a device that determines the flow and quantity of current. Transistors have the ability to switch and **amplify** electronic signals.



bipolar transistor

There are several different types of transistor: the **bipolar transistor**, the **junction field effect transistor (JFET)** and the **metal-oxide semiconductor field-effect transistor (MOSFET)**. Both FET and bipolar transistors need a **bias** voltage in order to turn on.

A bipolar transistor has three terminals. An electrical current flows into the first terminal, known as the **base**. The base changes the current flow between the **emitter** and **collector**.

Field effect transistors also have three terminals. However, the terminals have different names: the **gate**, **source**, and **drain**. The other difference is that voltage applied to the gate changes the current flow between the source and drain. MOSFETs have two main operating modes: **enhancement mode** and **depletion mode**. Depletion mode transistors are "normally on" whereas enhancement mode transistors are "normally off."

Get ready!

1 Before you read the passage, talk about these questions.

1 What are two types of transistor?

2 What are the three terminals in a FET transistor?

Reading

2 Read the article. Then, complete the table.

Transistor	Information
Bipolar	______ ______
JFET	______ ______
MOSFET	______ ______

Vocabulary

3 Match the words (1-7) with the definitions (A-G).

1 _ amplify

2 _ bias

3 _ drain

4 _ enhancement mode

5 _ gate

6 _ JFET

7 _ source

A an operating mode where the channel is free of charge carriers when the gate source voltage is zero.

B the part of a transistor where charge-carrying holes originate

C a type of transistor that has a gate, source, and drain

D a fixed voltage, applied to a device, in order to control its operation

E the controlling terminal that alters the current flow between the source and drain

F to increase the power of a signal

G the part of a FET that does the same job as the collector

4 **Read the sentence pair. Choose where the words best fit the blanks.**

1 **base / depletion mode**

A ________________ transistors are devices that are "normally on."

B The ________________ changes the flow of current between two terminals.

2 **MOSFET / emitter**

A ________________ is a kind of transistor that requires the least amount of signal current in order to turn on.

B The ________________ is the section of a transistor where charge-carrying holes originate.

3 **bipolar transistor / collector**

A Once charge carriers have left the base, they flow into the ________________ .

B A ________________ is a piece of equipment used to amplify and switch electronic signals.

5 **Listen and read the article again. What do transistors do?**

Listening

6 **Listen to a conversation between a customer and a tech. Mark the following statements as true (T) or false (F).**

1 __ The computer model is usually a good one.

2 __ The computer's transistor does not work correctly.

3 __ The man offers to give her a new computer.

7 **Listen again and complete the conversation.**

Customer: I bought this computer here last week, and I'm already having problems with it.

Tech: I apologize for the **1** ______. Can I take a look at it?

Customer: Sure, but I don't know that I still want it. What kind of computer breaks **2** ______ ______ ______?

Tech: I'm so sorry it's given you difficulties. We don't usually have problems with **3** ______ ______.

Customer: Really?

Tech: Okay, I think I know what the issue is. According to your computer's **4** ______ ______, it's part of a batch that got faulty transistors.

Customer: Well that **5** ______ ______.

Tech: I can **6** ______ ______ ______ fairly easily.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

I'm already having ...

I apologize for ...

How about ...

Student A: You are a customer in an electronics store. Talk to Student B about:

- a problem with a purchase
- the cause of the problem
- possible compensation

Student B: You are a tech in an electronics store. Talk to Student A about the computer.

Writing

9 **Use the article and the conversation from Task 8 to fill out the notice from the stereo manufacturer.**

NOTICE FORM

Repair Needed

Item affected: ________________

Repair needed: ________________

____

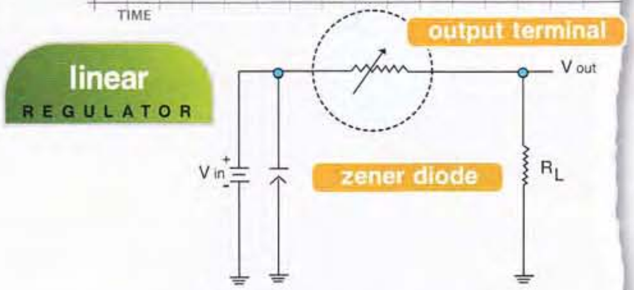
Suggested customer compensation:

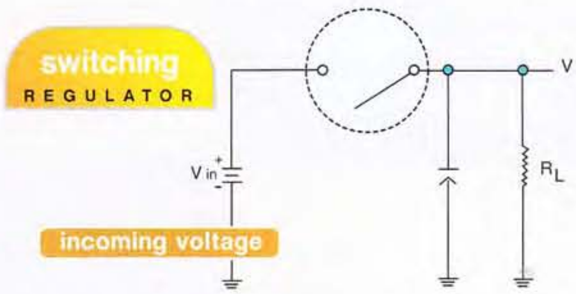
____

____

____

15 Voltage regulators





A **voltage regulator compensates** for excess and spare voltage by dispersing it evenly. That way, the voltage level stays constant. **Zener diodes** are used in most voltage regulators. They set the output voltage. The **series pass transistor** delivers the current. Meanwhile, the automatic controller ensures that everything is working properly. Read the following directions for replacing a voltage regulator (Look at page five to learn more about **pulse-width modulation** in regulators).

Linear Regulators

1 Connect the positive side of the **incoming** voltage to the terminal. Then attach the incoming power to the base terminal.

2 Connect the regulator's **output** terminal to the circuit requiring regulated voltage.

3 Link the circuit's base to the regulator's base terminal.

Switching Regulators

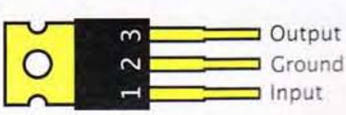
1 Fasten the incoming voltage's positive side to the input terminal.

2 Connect the incoming circuit to the base terminal.

3 Place the necessary filters into the output and feedback circuits. Switching regulators require filters to **detect** and **alter** excess noise.

4 Attach the **regulated** output to the circuit that requires regulated voltage.

If the electrical device uses a battery, **charge up** the battery.



Get ready!

1 Before you read the passage, talk about these questions.

1 What are two types of voltage regulators?

2 What kind of diode do most voltage regulators use?

Reading

2 Read the manual. Then, choose the correct answers.

1 What is the purpose of the passage?

A to discuss how regulators work

B to describe a type of regulator

C to explain how to build a regulator

D to compare the different parts of a regulator

2 What does a switching regulator do?

A keeps batteries charged

B creates a link between circuits

C regulates output to circuits

D replaces linear regulators in devices

3 Which of the following determines what the outgoing voltage will be?

A a zener diode

B a series pass transistor

C a pulse-width modulation

D a feedback circuit

Vocabulary

3 Match the words (1-8) with the definitions (A-H).

1 __ incoming	5 __ linear regulator
2 __ output	6 __ zener diode
3 __ detect	7 __ pulse-width modulation
4 __ alter	8 __ series pass transistor

A to change something

B the direction running towards an object

C a method used to control power

D a simple device that controls voltage

E anything that an object produces

F device that allows current to move back and forth

G device that converts voltage at a stable, constant level

H notice an object or change in pattern

4 **Fill in the blanks with the correct words and phrases from the word bank.**

Word BANK

charge up   regulate   switching regulator

1 To help distribute the energy evenly, I have to ____________ the current.

2 I got a ____________ because it works more efficiently than the linear regulator.

3 I have to let the battery ____________ before I can use my phone.

5 **Listen and read the manual again. Why are regulators important?**

Listening

6 **Listen to a conversation between two electronics techs. Mark the following statements as true (T) or false (F).**

1 __ The man wasn't sure which regulator to use.

2 __ The woman said that it did not matter which regulator they used.

3 __ The woman said she would help the man finish the laptop.

7 **Listen again and complete the conversation.**

Tech 1: Hi Brad. Are you almost done fixing that laptop?

Tech 2: Not yet. I'm having a bit of 1 ______ ______.

Tech 1: What's the problem?

Tech 2: I'm still deciding on what type 2 ______ ______ to install.

Tech 1: Well whichever type you choose needs to 3 ______ ______ since it won't be attached to a permanent power source.

Tech 2: I know. That's what I was thinking.

Tech 1: Which would work better, a switching regulator or a 4 ______ ______?

Tech 2: I think the switching regulator works more efficiently.

Tech 1: I think you're right.

Tech 2: So we both agree that the 5 ______ ______ would be the better choice in this scenario?

Tech 1: Yes, I think so.

Tech 2: Now that we've decided to use the switching regulator, I can go ahead and 6 ______ ______ the work on this laptop.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

What are you ...

It needs ...

Do you think ...

Student A: You are technician. Talk to Student B about:

- working on the TV
- choosing a regulator
- finishing the TV

Student B: You are a technician. Talk to Student A about which regulator would work best for the TV.

Writing

9 **Use the manual and the conversation from Task 8 to fill out the work order for the repaired TV.**

Bob's Hardware

Work Report

Date: December 18

Submitted by: Brad Compton

Work Order #: 46984

I completed work order #46984 on December 18.

____

____

____

____

Glossary

abuse [V-T-U2] If you **abuse** something you treat it badly.

active element [N-COUNT-U4] An **active element** is a part of an electronics product that is able to create energy.

activity [N-COUNT-U3] **Activity** is action or movement.

age [N-COUNT-U2] The **age** of something is how long it has existed.

alter [V-T-U15] To **alter** a sound is to change it.

amplify [V-T-U14] To **amplify** a signal is to increase the power of a signal.

amplitude [N-UNCOUNT-U5] **Amplitude** is the distance between the middle and the bottom or top of an electrical wave.

analog [ADJ-U5] If a signal is **analog**, it uses signals that change the voltage to form a pattern, which is similar to the data being sent.

analog-to-digital converter [N-COUNT-U5] An **analog-to-digital converter** is a device that changes analog information into digital information.

anode [N-COUNT-U8] An **anode** is the part of a diode where current flows in from the outside.

apart [ADJ-U3] If a piece of equipment is **apart**, it is in parts, or it is not together.

audio taper pot [N-COUNT-U12] An **audio taper pot** is another name for a log taper pot.

band [N-COUNT-U8] The **band** on a diode is used to identify the terminal of the cathode.

base [N-COUNT-U14] The **base** is the part of a transistor that is between the emitter and the collector. It changes the flow of current between the other two terminals.

bias [N-UNCOUNT-U14] **Bias** is a fixed voltage, applied to a device, in order to control its operation.

biasing element [N-COUNT-U8] A **biasing element** is a potential source used with diodes.

bipolar transistor [N-COUNT-U14] A **bipolar transistor** is made up of three elements that are linked by two junctions. The three elements are the base, collector, and emitter. Transistors are used to amplify and/or switch electronic signals.

blow [V-T-U9] To **blow** a fuse is to exceed the limit of the fuse.

break down [PHRASAL V-U1] If something **breaks down**, it stops working suddenly.

bridge rectifier [N-COUNT-U8] A **bridge rectifier** has four rectifiers arranged in a diamond-like configuration.

capacitor [N-COUNT-U6] A **capacitor** is a device made of two or more plates separated by an insulator, that is used to store electricity and discharge it back to a circuit.

carbon composition resistor [N-COUNT-U11] A **carbon composition resistor** is a resistor made of carbon that is found in nearly every electronic device.

cathode [N-COUNT-U8] A **cathode** is the part of a diode where current flows out from the inside.

ceramic [N-UNCOUNT-U7] **Ceramic** is a hard material made by heating clay at a high temperature.

ceramic capacitor [N-COUNT-U6] A **ceramic capacitor** uses ceramic as its insulator, has a small range, and is found in radio circuits and bypass applications.

charge up [PHRASAL V-U15] To **charge up** a battery, is to allow it to accumulate the power needed to run.

chip [N-COUNT-U10] A **chip** is an integrated circuit which is used in computers, cell phones, and many other electronic devices.

circuit [N-COUNT-U4] A **circuit** is the complete path of an electric current.

closed [ADJ-U4] If a circuit is **closed**, the current can travel from one end of the power source to the other. A circuit needs to be closed in order to work.

coil [N-COUNT-U9] A **coil** is a strip of metal that is wound in a spiral.

collector [N-COUNT-U14] The **collector** is the semiconductor part of a transistor. After charge carriers leave the base, they flow into the collector.

color code [N-COUNT-U11] A **color code** is a series of colors that represent numbers that are used to state a resistor's resistance value in ohms.

compensate [V-T-U15] To **compensate**, is to pay for or make up the difference for something.

component [N-COUNT-U4] A **component** is an element in a circuit.

conditions [N-COUNT PLURAL-U2] The **conditions** something is kept in is the environment it is used in.

contact [N-COUNT-U13] A **contact** is a device used to conduct current.

control [V-T-U13] To **control** equipment is to make it work or move in the way that you want it to.

corrosion [N-UNCOUNT-U1] **Corrosion** is damage to metal due to water.

crystal [N-COUNT or UNCOUNT-U7] **Crystal** is very high quality clear glass.

custom [ADJ-U10] If an electronic device is **custom** made, it is specially designed for a specific purpose.

cycle [N-COUNT-U5] A **cycle** is one repetition of a waveform.

cylinder [N-COUNT-U9] A **cylinder** object is shaped with circular ends and straight sides.

dead [ADJ-U3] If a wire or a piece of electronic equipment is **dead**, it is not working at all.

defective [ADJ-U10] If an electronic device is **defective**, it does not work properly.

depletion mode [N-UNCOUNT-U14] **Depletion mode** is an operating mode where reverse gate-source voltage is used to reduce the amount of free carriers in the channel. This makes the channel smaller and raises its resistance. Depletion mode transistors are "normally on" devices.

detect [V-T-U15] To **detect** is to notice an object or a change in pattern.

digital [ADJ-U5] If something is **digital**, it uses signals that are based on the binary numbers of 0 and 1. Digital signals are easier to track and store than analog ones.

diode [N-COUNT-U8] A **diode** is a one way valve that allows current to flow through it.

disintegrate [V-I-U11] To **disintegrate** is to fall apart or break down.

display [N-COUNT-U3] The **display** is the screen on an electronic device.

dissipate [V-I or T-U11] To **dissipate** is to spread out or cause something to spread out.

double rectifier [N-COUNT-U8] A **double rectifier** has two rectifiers sharing one terminal.

drain [N-COUNT-U14] A **drain** does the same job as a collector. It is found inside FET transistors. After charge carriers leave the gate, they flow into the drain.

duty cycle [N-COUNT-U5] A **duty cycle** is the percentage of time spent in the "on" state in relation to the "off" state.

electrical stress [N-UNCOUNT-U1] **Electrical stress** is damage to a machine caused by a surge of power.

electrolytic capacitor [N-COUNT-U6] An **electrolytic capacitor** offers the highest capacity relative to its size, has a small range, and performs coupling and leafing functions.

eliminate [V-T-U3] To **eliminate** is to take something away so that it is not considered or chosen.

emitter [N-COUNT-U14] An **emitter** is the part of a transistor where charge-carrying holes originate.

encased [ADJ-U7] If something is **encased**, it is covered completely by something else.

enhancement mode [N-UNCOUNT-U14] **Enhancement mode** is an operating mode where the channel is free of charge carriers when the gate source voltage is zero. Enhancement mode transistors are "normally off" devices.

evaluation [N-COUNT-U2] An **evaluation** is an examination of something, leading to a conclusion about the best action to take.

exceed [V-T-U9] To **exceed** a limit is to go past an allowed amount or limit.

exhibit [V-T-U2] If a machine **exhibits** something, it shows something.

external [ADJ-U3] If something is **external**, it is on the outside, not on the inside.

failure [N-UNCOUNT-U1] **Failure** is when something cannot achieve its purpose.

fall time [N-COUNT-U5] The **fall time** is the amount of time it takes for the transition to fall from ninety percent to ten percent of its final height.

Glossary

fan [N-COUNT-U10] A **fan** is put inside a device to keep the chip from overheating.

farad [N-COUNT-U6] A **farad** is the unit that measures the ability of a capacitor to store energy, known as capacitance.

filter [N-COUNT-U7] A **filter** is a device that removes unwanted things that pass through it.

frequency [N-UNCOUNT-U5] **Frequency** is the amount of cycles that take place in one second of time.

fuse [N-COUNT-U9] A **fuse** protects a circuit against current surges.

gang [V-T-U12] To **gang** components is to arrange them into a group or a set.

gate [N-COUNT-U14] A **gate** does the same job as a base. It is the controlling terminal that changes the flow of current between the source and the drain.

generate [V-T-U7] To **generate** something is to produce that thing.

gradual [ADJ-U2] If an action is **gradual**, it happens slowly over a long period of time.

graphics card [N-COUNT-U14] A **graphics card** is a circuit board that controls the images that come on a computer screen and generates 3D images.

harmonic energy [N-UNCOUNT-U5] **Harmonic energy** is sounds that are made at multiples of the same frequency as a base noise.

heat stress [N-UNCOUNT-U1] **Heat stress** occurs when the power supply generates a lot of heat when it powers a large piece of equipment. The heat causes damage.

hiss [N-COUNT-U3] A **hiss** is a harsh s-sounding noise.

holder [N-COUNT-U9] A **holder** is something that contains a fuse.

hot side [N-COUNT-U9] The **hot side** is where wires that are not grounded are located.

hum [N-COUNT-U3] A **hum** is a deep, constant vibrating sound.

idle [ADJ-U2] If a device is **idle**, it is turned on, but nobody is using it.

incoming [ADJ-U15] If a current is an **incoming** current, it is running towards the object, not away from it.

in common [ADJ PHRASE-U2] If two things have something **in common**, they are similar in some way.

in operation [ADJ PHRASE-U2] If something is **in operation**, it is currently working.

in parallel [ADJ PHRASE-U4] If a circuit is **in parallel**, several components are joined across the power source's two terminals.

in series [ADJ PHRASE-U4] If a circuit is **in series**, the current has to pass through a first circuit component, before it is able to pass through a second or third one.

insulator [N-COUNT-U6] An **insulator** is a material that does not conduct electricity.

interchange [V-T-U11] To **interchange** things is to have each thing replace the position or function of the other(s).

isolate [V-T-U12] To **isolate** something is to separate it from other things.

junction field effect transistor (JFET) [N-COUNT-U14] A **junction field effect transistor (JFET)** is a type of transistor that is made up of three elements. These elements are called the gate, the source and the drain. The JFET does not need much signal current in order to turn on.

large scale integrated chip (LSI) [N-COUNT-U14] A **large scale integrated chip (LSI)** is an integrated circuit that contains thousands of semiconductors.

lead [N-UNCOUNT-U7] A **lead** is a metal prong used to mount a device to a circuit board.

leg [N-COUNT-U4] A **leg** is a section of an electrical circuit.

light-emitting diode (LED) [N-COUNT-U8] A **light-emitting diode (LED)** emits light when a current passes through it.

limit [V-T-U11] To **limit** something is to prevent something from increasing beyond a certain point.

linear regulator [N-COUNT-U15] A **linear regulator** controls outgoing voltage coming from a less stable inbound voltage, is inexpensive, and produces better sound than a switching regulator.

linear taper pot [N-COUNT-U12] A **linear taper pot** is a pot that provides an even change in resistance for each degree of rotation from end to end.

log taper pot [N-COUNT-U12] A **log taper pot** is a pot that uses a logarithmic resistance curve to adjust sound volume so that it appears to change at a constant rate.

malfunctioning [ADJ-U3] If a piece of equipment is **malfunctioning**, it is not working properly.

manufacturer [N-COUNT-U2] A **manufacturer** is a company or person that makes products.

mark [N-COUNT-U6] A **mark** is a letter, word, or symbol printed on or etched into something.

maximum [N-COUNT-U8] The **maximum** is the highest amount or degree that is possible.

mechanical wear [N-UNCOUNT-U1] **Mechanical wear** is when products stop working because moving parts break.

metal oxide resistor [N-COUNT-U11] A **metal oxide resistor** is a type of resistor with a tighter tolerance than carbon or wire-wound resistors.

metal-oxide semiconductor field-effect transistor (MOSFET) [N-COUNT-U14] A **metal-oxide semiconductor field-effect transistor (MOSFET)** is a type of transistor that is like a JFET. However, it takes even less signal current to turn on a MOSFET.

microscopic [ADJ-U10] If an object is **microscopic**, it is too small to see with the naked eye.

mortality [N-UNCOUNT-U1] **Mortality** is the fact that things die. It is usually used to talk about people, but can also be used to describe the fact that some products in a batch will fail.

normally closed [ADJ-U13] If something is **normally closed**, it means that the contacts are touching, even when the relay or switch is in the "off" position. Electricity can pass between the contacts.

normally open [ADJ-U13] If something is **normally open**, it means that the contacts do not touch when the relay or switch is in the "off" position. Electricity cannot pass between the contacts.

open [ADJ-U4] If a circuit is **open**, there is a break in it that stops current from flowing from one end of the power source to the other.

opposition [N-UNCOUNT-U11] **Opposition** is an action done to resist or stop something else.

origin [N-COUNT-U4] An **origin** is the place where something starts to exist. In a circuit, the origin is the place where current comes from.

output [N-UNCOUNT-U15] **Output** is the voltage, sound, or anything else that a speaker or other object produces.

passage [N-UNCOUNT-U13] **Passage** is movement through, past, or over a location.

peak inverse voltage (PIV) [N-COUNT-U8] The **peak inverse voltage (PIV)** refers to the highest value of the input voltage that a diode can handle before allowing it to pass.

phase relationship [N-COUNT-U5] A **phase relationship** is the relative position in time of two different signals. It is shown in degrees.

physical stress [N-UNCOUNT-U1] **Physical stress** is damage caused to a machine by the way it is treated.

piezoelectric effect [N-COUNT-U7] The **piezoelectric effect** is when pressure is applied to a material and it results in the production of electricity. The same materials vibrate when subjected to electricity.

plastic capacitor [N-COUNT-U6] A **plastic capacitor** uses polystyrene as its insulator, has excellent stability, and performs bypass and coupling functions.

plate [N-COUNT-U6] A **plate** is flat piece of metal or other material.

pole [N-COUNT-U13] A **pole** is a set of contacts.

potentiometer (pot) [N-COUNT-U12] A **potentiometer (pot)** is an electronic component, typically with three leads, that varies how much current flows through a circuit, and can be used to adjust analog signals (such as volume and power supply).

power surge [N-COUNT-U1] A **power surge** is a sudden, great increase in the power supply.

protect [V-T-U9] To **protect** something is to keep it from being harmed or damaged.

pulse [N-COUNT-U8] A **pulse** is a short and sudden change in a current.

pulse-width modulation (PWM) [N-UNCOUNT-U15] **Pulse-width modulation (PWM)** is a method that is used to control the power that is going to an electrical device.

quartz [N-UNCOUNT-U7] **Quartz** is a form of silicon that occurs in nature and is used in making watches and electronics.

range [N-COUNT-U6] A **range** is a series of numbers bounded on either side by a highest and lowest amount.

rating [N-COUNT-U6] A **rating** is the upper limit of voltage a capacitor can handle before failing.

rectangular [ADJ-U9] If an object is **rectangular**, it has four right angles.

rectifier [N-COUNT-U8] A **rectifier** is a large diode that forces an alternating current to become direct.

rectify [V-T-U4] To **rectify** is to correct a problem. When current is rectified, it is changed into a current with one polarity.

regulate [V-T-U15] To **regulate** a current is to control it.

relay [N-COUNT-U13] A **relay** is a switch that is controlled by another electrical circuit. Many relays use an electromagnet.

remote control [N-COUNT-U3] A **remote control** is a device that controls a machine from a distance.

represent [V-T-U11] To **represent** is to be the symbol for something.

reservoir [N-COUNT-U4] A **reservoir** is something that can store energy. It is used to keep voltage even.

resistance [N-UNCOUNT-U1] **Resistance** is a force that stops something else from moving effectively.

resistance curve [N-COUNT-U12] A **resistance curve** is a graphic representation of how a pot's resistance value changes as another variable changes.

resistor [N-COUNT-U11] A **resistor** is a component that limits the flow of electricity in an electronic device.

resonator [N-COUNT-U7] A **resonator** is a device that oscillates at certain frequencies.

reversed polarity [N-UNCOUNT-U1] **Reversed polarity** is when an electric current runs through a machine the wrong way.

rheostat [N-COUNT-U12] A **rheostat** is a pot with a wiper and a single lead connecting to the resistive element.

rise time [N-COUNT-U5] The **rise time** is the amount of time it takes for the transition to rise from ten percent to ninety percent of its final height.

rotary [ADJ-U12] If something is **rotary**, it can be rotated around an axis.

sawtooth wave [N-COUNT-U5] A **sawtooth wave** is a type of wave that forms a pattern like that found on the blade of a saw.

scramble [V-T-U3] To **scramble** is to jumble or distort something.

series pass transistor [N-COUNT-U15] A **series pass transistor** converts inbound voltage into a lower constant voltage.

shaft [N-COUNT-U12] A **shaft** is a straight rod that is typically used to transmit motion and torque.

short circuit [N-COUNT-U4] A **short circuit** is when current skips over part of the circuit and travels straight to the other end of the power source.

shorted [ADJ-U4] If something is **shorted**, it causes current to skip over part of a circuit and travel to the other end of the power source.

shut down [PHRASAL V-U13] To **shut down** is to stop working.

signal [N-COUNT-U5] An electronic **signal** is a signal that carries information between two pieces of electronic equipment.

silicon [N-UNCOUNT-U10] **Silicon** is a natural, non-metallic element that is used to make many electronic devices.

sine wave [N-COUNT-U5] A **sine wave** is a type of smooth wave that has a pure tone. It can be used to show the strength of an alternating current.

slab [N-COUNT-U7] A **slab** is a piece of stone or other hard material that is flat and usually thick.

slice [N-COUNT-U7] A **slice** is a flat piece of material cut from a larger piece of that material.

slow-blow fuse [N-COUNT-U9] A **slow-blow fuse** demands a high start-up current and has a time-delay.

small scale integrated chip (SSI) [N-COUNT-U10] A **small scale integrated chip (SSI)** is a chip that contains only a few semiconductors.

source [N-COUNT-U14] A **source** does the same job as an emitter. It is the part of a transistor where charge-carrying holes originate.

spring [N-COUNT-U9] A **spring** is a strip of steel that recovers its shape when compressed.

square wave [N-COUNT-U5] A **square wave** is a type of wave made by repeatedly and quickly turning a signal all the way on and then all the way off.

stage [N-COUNT-U4] A **stage** is a part of an electronics product that does one job.

substrate [N-COUNT-U12] A **substrate** is a base layer supporting a circuit.

sudden [ADJ-U2] If an action is **sudden**, it happens very quickly.

surface-mount [N-COUNT-U9] A **surface-mount** fuse attaches to the flat surface of an object.

switch [N-COUNT-U13] A **switch** is a device used to allow or prevent the passage of current.

switching regulator [N-COUNT-U15] A **switching regulator** controls outgoing voltage that occurs from a less stable inbound voltage. It is more diverse than a linear regulator, and is better quality.

tantalum capacitor [N-COUNT-U6] A **tantalum capacitor** uses ceramic as its insulator, has a small range, and performs filtering and bypass functions in the presence of high frequencies.

tap [V-T-U3] To **tap** is to hit something lightly with a finger.

terminal [N-COUNT-U12] A **terminal** is a point where a conductor from an electrical device connects to external circuits.

throw [N-COUNT-U13] A **throw** is a position that a switch can be in.

transistor [N-COUNT-U10] A **transistor** is a semiconductor used in electronics to function as a signal enhancer or a switch.

trimmer capacitor [N-COUNT-U6] A **trimmer capacitor** is a capacitor with a rotating plate and a fixed insulator that performs frequency adjustments for tuned circuits and oscillators.

trimpot [N-COUNT-U12] A **trimpot** is a small linear taper pot used to perform internal circuit adjustments such as in power supply.

unconnected [ADJ-U13] If something is **unconnected**, it is not linked to a system.

valve [N-COUNT-U8] A **valve** is a device that controls the flow of something.

variety [N-COUNT-U13] A **variety** is a group or amount of people or objects that are all different.

vibrate [V-I-U7] To **vibrate** is to shake back and forth in regular movements that are short and quick.

voltage regulator [N-COUNT-U15] A **voltage regulator** compensates for excess and spare voltage by dispersing it evenly.

warm up [PHRASAL V-U3] To **warm up** a machine is to run it until it is at the right temperature to work properly.

waveform [N-COUNT-U5] A **waveform** is a signal, as shown on a graph.

wear out [PHRASAL V-U1] If something **wears out**, it is used so much that eventually it doesn't work as well, or it stops working.

wiper [N-COUNT-U12] A **wiper** is a movable metal contact that touches the resistive element. When it is turned it increases resistance relative to one outer lead, while decreasing it relative to the other.

wire [V-T-U4] To **wire** something is to link together long, thin threads of metal inside a piece of electrical equipment.

wire-wound resistor [N-COUNT-U11] A **wire-wound resistor** is a type of resistor with a wire coiled around it, that can dissipate more heat than a carbon composition resister, but is not suitable for a high-frequency circuit, as they have some inductance.

zener diode [N-COUNT-U15] A **zener diode** allows a current to move forward as well as backward when the voltage is higher than a certain value.

Career Paths

Electronics

Book 3

Virginia Evans

Jenny Dooley

Carl Taylor

Express Publishing

Scope and sequence

Unit	Topic	Reading context	Vocabulary	Function
1	Diagrams	Magazine article	diagram, navigate, block diagram, schematic diagram, pictorial diagram, lay out, section, conceptual, specify, overall, drawing, service manual, placement, chassis	Coming to an agreement
2	Call numbers	Instructions	call number, unique, unrelated, designation, multi-section, identifier, label, standardize, look up, method, far away	Expressing annoyance
3	Disassembling devices	Trade magazine article	case, sealed, snap, disassemble, force, panel, hidden, indentation, smack, disconnect, come off, stuck, patience, adhesive	Giving reminders
4	Replacing components	Article on replacing components	double-check, clear, molten, suck, flow, thermal, absorption, multi-layer, deform, heatsinking, chop off, coating, clip, delaminate	Rejecting a suggestion
5	Choosing components	Column on choosing components	mail-order, standardized, stockpile, oxidation, build up, reuse, similar, substitute, consider, application	Interrupting someone's work
6	Power supply	Textbook excerpt	power supply, regulation system, round, square, congregate, toroid, microprocessor, hard switch, linear power supply, filter, voltage inverter, switching supply, inductor	Describing things
7	Input/Output	Online article	input, collect, feed, antenna, cable, resonate, varactor, composite, input jack, transducer, output, amplification, display, audio	Asking questions
8	Signal processing	Work order	process, take in, retrieve, play back, record, send, small-scale, combine, synthesize, parameters, convert, tuning	Expressing doubt
9	Heat sinks	Magazine article	heat sink, speed, cool down, attachment, overheat, draw away, thermal conductor, airflow, aluminum, copper, active heat sink, passive heat sink, case fan	Asking for an explanation
10	Separating the snaps	Manual excerpt	snap, necessary, slot, pop, unhook, half, seam, give, pry, visible, gap, melt, figure out	Expressing resolution
11	Removing ribbon cables	Instructions	ribbon cable, complex, delicate, socket, latch, permanent marker, tab, flip-up latch, slide latch, custom made, reinforced, crooked, parallel	Giving encouragement
12	Layers	Textbook excerpt	layer, metal shield, circuit board, battery compartment, precisely, industry standard, fixed, nut, counterclockwise, drawing paper, lose track, stack	Correcting mistakes
13	Interior reassembly	Online article	reassembly, reverse, inner, multiple, corrosion, overtighten, fractures, glyptal, wipe, lead dress, tack down, secure, blob, crimping, slice	Asking for advice
14	Exterior reassembly	Trade magazine article	line up, pressure, bulge, style, wobbly, noticeable, weak, strip, mend, snugly, grip, test out, sturdy	Asking if something is acceptable
15	Disposal of electronics	Newspaper article	refurbish, hazardous waste, obsolete, toxic, recycle, donate, break down, electronic waste, personal data, dispose of, leech, collection program, harmful, retailer, landfill	Making a donation

Table of contents

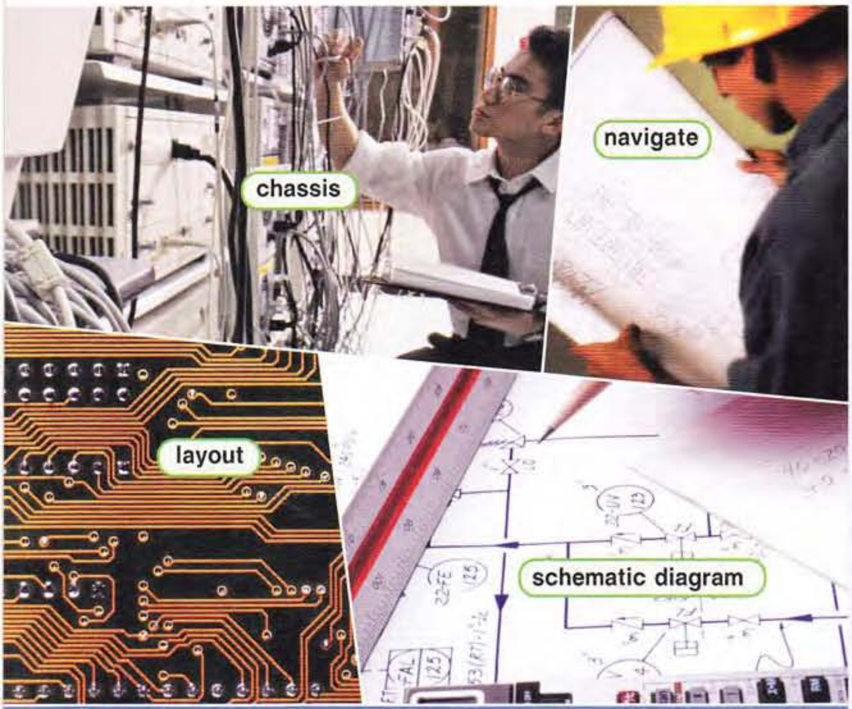
1 Diagrams

Get ready!

1 Before you read the passage, talk about these questions.

1 What are some types of diagrams used in electronics?

2 Where are diagrams located?



Reading Electronics Manuals

by J. Ford

Understanding electronics service manuals can be very helpful for repairs at home or at your business. Most **service manuals** contain a lot of product information, troubleshooting guides, and **diagrams**. This article explains several types of diagrams that will help you to understand your manuals.

The most basic type of diagram is the **block diagram**. This **conceptual** diagram is easy to understand. The functions of internal circuits are shown using simple symbols. This type of diagram will help you **lay out** the circuits into different **sections**. This will give an **overall** picture of how circuits function and connect with one another.

Schematic diagrams give a more detailed view of internal circuits and components. This diagram will **specify** individual components of an item that may need to be repaired. The schematic diagram does not show function, but it is still the most useful. It contains the most detail regarding circuit design and component layout.

The **pictorial diagrams** show **drawings** of circuits and how they connect with each other. The drawings also assist in the layout and **placement** of components. This diagram is helpful for finding the components on the **chassis** or circuit board.

Knowing the differences between these common diagrams will help in **navigating** the service manual.

Reading

2 Read the magazine article. Then, choose the correct answers.

1 What is the main idea of this passage?

A how to draw a conceptual diagram

B how to repair a circuit board

C how to understand electronics manuals

D how to divide parts into sections

2 Which of the following is NOT discussed in the article?

A the function of a chassis

B several types of diagrams

C help in navigating a manual

D a helpful diagram for circuit boards

3 According to the article, which diagram has the most details?

A schematic | C drawing

B block | D pictorial

Vocabulary

3 Match the words (1-8) with the definitions (A-H).

1 __ section | 5 __ chassis

2 __ overall | 6 __ placement

3 __ diagram | 7 __ conceptual

4 __ lay out | 8 __ drawing

A represents an object with lines

B the specific place where an object is put

C the total or complete part of something

D using ideas or theories to explain or show something

E a drawing that explains how something works

F to design or arrange items

G the frame of an electrical device

H a specific portion or part of something

4 **Read the sentence pair. Choose where the words best fit the blanks.**

1 **schematic diagram / block diagram**

A The ______________ is the most detailed diagram.

B The ______________ is the most conceptual diagram.

2 **navigate / specify**

A Knowing the types of diagrams will help to ______________ the manual.

B The detailed diagram will help to ______________ certain parts to be repaired.

3 **service manual / pictorial diagram**

A Use the ______________ to see a drawing of the parts.

B Check the ______________ for help with troubleshooting.

5 **Listen and read the magazine article again. What is considered the most useful type of diagram?**

Listening

6 **Listen to a conversation between two electronics techs. Mark the following statements as true (T) or false (F).**

1 __ The man is missing the service manual.

2 __ The woman suggests finding a detailed picture.

3 __ They decide to look at the schematic diagram for help.

7 **Listen again and complete the conversation.**

Tech 1: Well, it would be helpful if I could see a **1** ______ ______ ______ ______.

Tech 2: Most manuals have diagrams in them. That one should, too. Check the index.

Tech 1: Yep, the **2** ______ ______ has several different types of diagrams in it.

Tech 2: Great. **3** ______ ______ of the components would be really helpful, don't you think?

Tech 1: You're right. Okay, so this manual has block, schematic, and **4** ______ ______.

Tech 2: Well, block diagrams are the most **5** ______, ______ ones. I don't think that will be helpful.

Tech 1: Then what about the pictorial diagrams?

Tech 2: No, that's more for showing connections of parts. You need the **6** ______ ______.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

Can you help ...

Do you have ...

I think ...

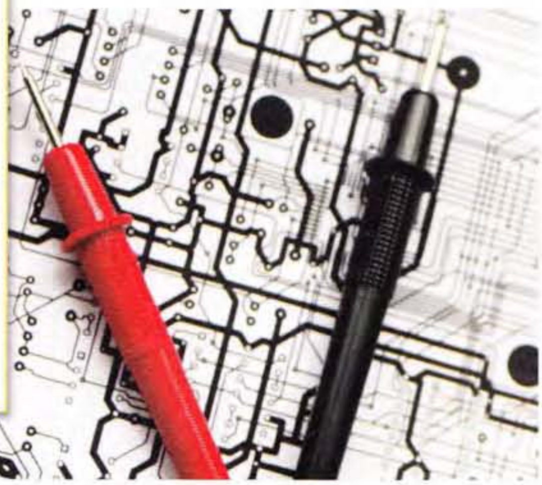
Student A: You are an electronics tech. Talk to Student B about fixing the TV:

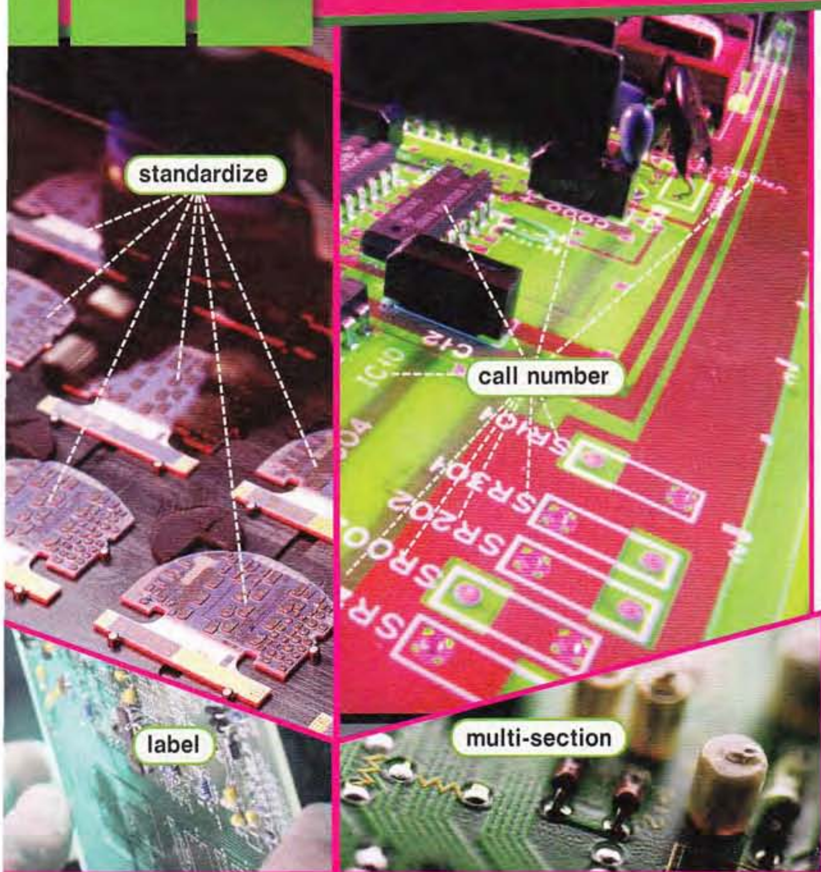
- Using a service manual
- What you should look for first
- What diagrams are in the manual

Student B: You are an electronics tech. Talk to Student A about using the manual to fix the TV.

Writing

9 **Use the magazine article and the conversation from Task 8 to write an excerpt from an article on reading electronics manuals. Include a suggestion for where to look for diagrams, the different kinds of diagrams and which diagrams may be most helpful in different situations.**





Using Call Numbers

Every part of your device is **labeled** with a call **number**. These call numbers are all **unique**. Furthermore, they are **unrelated** to other component numbers. Because they are combinations of letters and numbers, call numbers look complicated. However, our brand has an easy-to-use **method**.
The first "number" is always a letter, such as "C" or "R." This letter is a quick and easy **identifier**. It identifies what kind of component it is. For instance, a component with a "C" **designation** is a capacitor. Likewise, a component with an "R" designation is a resistor.
After the letter, there are a few numbers. Each of these numbers stands for something different. For example, the first number specifies the component's location inside the device. Therefore, two components starting with 4 won't be **far away** from each other.
The beginning letter will be the same on almost every device. The electronics industry has worked hard to **standardize** this. However, the numbers are not standardized. They differ depending on the manufacturer.
You may still have questions about specific call numbers. If so, just **look up** the numbers on the list in the service manual. Please note that **multi-section** parts have more than one call number.

Get ready!

1 Before you read the passage, talk about these questions.

1 How are electronic components identified?
2 What kind of component has more than one section?

Reading

2 Read the instructions. Then, choose the correct answers.

1 What is the purpose of the passage?
  A to explain where call numbers are located
  B to describe how to look up call numbers
  C to give information on using call numbers
  D to show how call numbers are standardized

2 What does the first letter of a call number tell a technician?
  A where the part is located
  B what kind of part it is
  C that the call number is unique
  D that it is a multi-section part

3 What is NOT mentioned in the passage?
  A what the third number stands for
  B what an 'R' designation stands for
  C what the first number stands for
  D how multi-section parts are labeled

Vocabulary

3 Fill in the blanks with the correct words: *unique, standardizes, method, label, look up, far away.*

1 ________ the call number for this component, please.
2 Since both components start with 2, they won't be ________ from each other.
3 The component was different than all the others, making it ________.
4 The company ________ its manufacturing procedures so they are always the same.
5 ________ all the products clearly, please.
6 Using plastic cups is an easy ________ for storing small parts.

4 **Read the sentence and choose the correct word.**

1 The device has two **multi-section / identifier** parts.
2 What is the **call number / method** for the part?
3 The two things are entirely **unrelated / far away**.
4 The **method / designation** for the part is R432.
5 "C" is the **call number / identifier** for capacitors.

5 **Listen and read the instructions again. Why is it important for technicians to look at a part's call number?**

Listening

6 **Listen to a conversation between an apprentice technician and an experienced technician. Mark the following statements as true (T) or false (F).**

1 __ "Q" stands for product schematic.
2 __ The woman does not know what the part is.
3 __ The man suggests looking at a list of call numbers.

7 **Listen again and complete the conversation.**

New Tech:	This is **1** ______ ______. What do these numbers mean?
Experienced Tech:	**2** ______ ______ ______, Mary? Can I help?
New Tech:	Oh, I have no idea what this component is. How am I **3** ______ ______ ______ where it goes when I don't know what it is.
Experienced Tech:	There's an easy way to tell. What's the **4** ______ ______?
New Tech:	It's Q254.
Experienced Tech:	Okay. Now, look at the call number list in the **5** ______ ______. What does 'Q' mean?
New Tech:	It says 'Q' stands for transistor. That's helpful. But how can I find out where it goes?
Experienced Tech:	We need to look at the **6** ______ ______.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

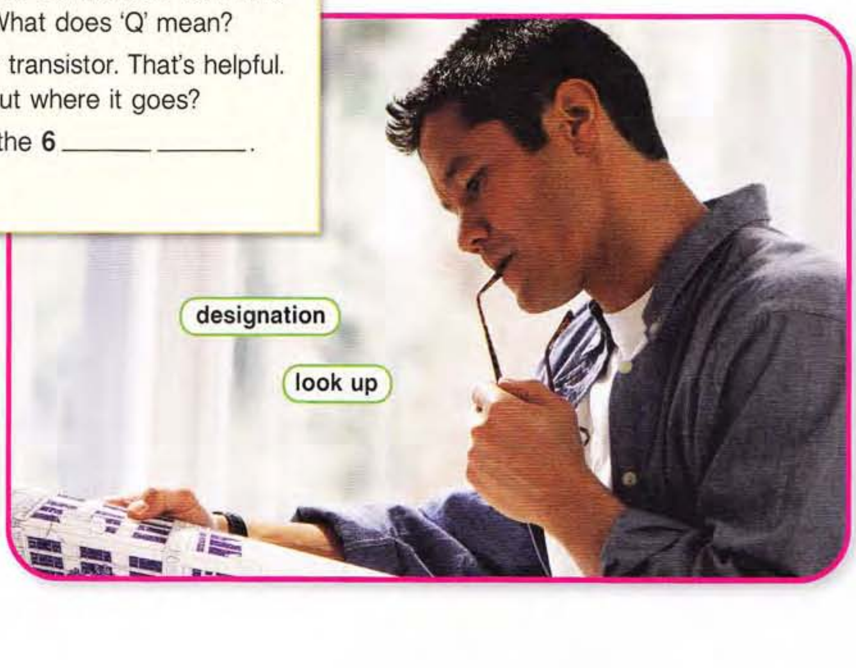
This is so annoying ...
How am I supposed to ..., when ...
Now, look at the ...

Student A: You are a new electronics technician. Talk to Student B about:
- your frustrations
- what you need help with
- why you need help

Student B: You are an experienced electronics technician. Talk to Student A about how to read call numbers.

Writing

9 **Use the instructions and the conversation from Task 8 to write instructions to a co-worker on the purpose of call numbers. Include what a call number is and how to use them.**



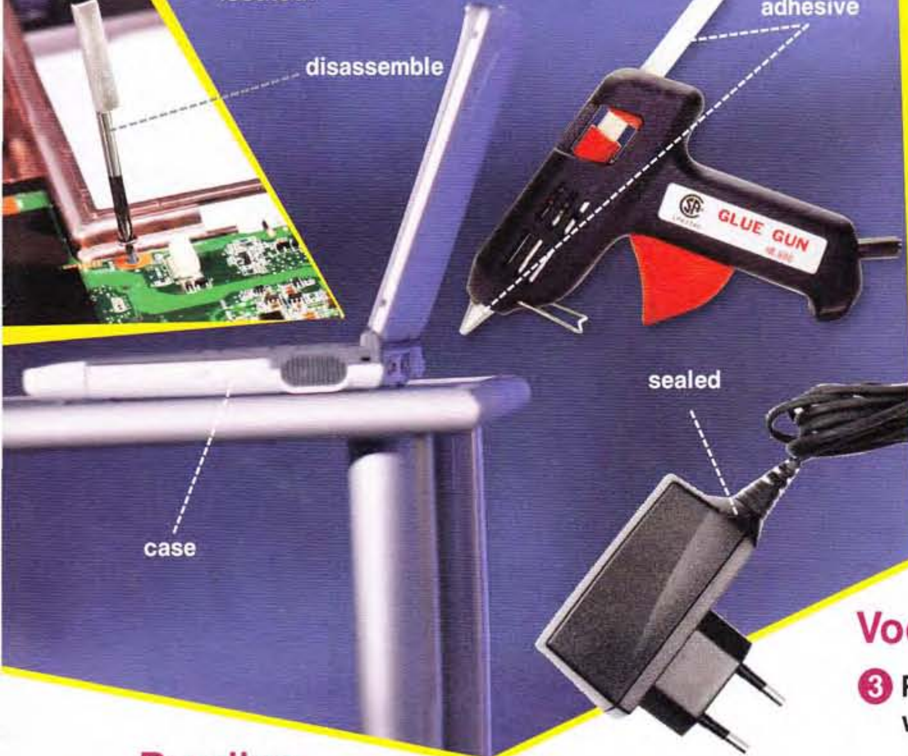
3 Disassembling devices

Get ready!

1 Before you read the passage, talk about these questions.

1 How can you view the internal components of an electronic device?

2 Where is the battery on most cell phones located?



Reading

2 Read the trade magazine. Then, choose the correct answers.

1 What is inferred about people who try to open equipment?

- **A** They are likely to cause damage.
- **B** They know how to fix the machine.
- **C** They found information online.
- **D** They open equipment accidentally.

2 Which of the following is NOT a usual method of holding devices together?

- **A** hidden snaps
- **B** screws
- **C** magnets
- **D** adhesive

3 Why is it sometimes necessary to remove labels?

- **A** There may be a panel underneath.
- **B** There may be a screw underneath.
- **C** The label may hold the case together.
- **D** There may be instructions underneath.

Getting inside equipment

If you're having problems getting inside equipment, there's a reason for that. Manufacturers don't want people to access the insides of machines. Problems occur if inexperienced people tamper with the interior of devices. Also, damage could occur if a panel drops off accidentally. So devices are deliberately **sealed**.

If you need to open a device, it's worth looking online. There may be instructions on how to **disassemble** it. Otherwise, follow the instructions below.

First, **disconnect** the device from the power source. Then remove anything that **comes off**. Screws are often **hidden** under **panels**. Screws can also be found under labels or rubber feet, so feel them for **indentations**. You may have to peel them back and remove **adhesive** to access the screw. Once you remove the screws, the **case** may still not come off. If this happens, don't **force** it. There is probably a good reason why it is **stuck**. There may be hidden **snaps** keeping it closed. Most importantly, keep your **patience**. If you poke the inside with a screwdriver, or **smack** the device, you will damage something.

Vocabulary

3 Read the sentence pair. Choose where the words best fit the blanks.

1 **come off / disconnect**

- **A** __________ the machine from the power before you work on it.
- **B** I can't get this panel to __________.

2 **hidden / stuck**

- **A** I can't open this phone. The cover is __________.
- **B** There were __________ cameras in the store.

3 **force / disassemble**

- **A** It won't open and I don't want to __________ it.
- **B** It took me about 30 minutes to __________ the stereo.

4 **sealed / smack**

- **A** Don't __________ the tablet, you'll damage it.
- **B** The laptop's parts are __________ in to protect them.

4 Fill in the blanks with the correct words from the word bank.

Word BANK

indentation case snaps
panel patience adhesive

1 The __________ holding the case shut broke.
2 See if you can feel a(an) __________.
3 You need to have __________ when working on electronics - you can't rush things.
4 Jane wants to look at the inside of her computer but she can't remove the __________.
5 The battery __________ is on the bottom of the laptop.
6 Emory attached the sides of the case together using an all-purpose __________.

5 **Listen and read the trade magazine again. What should you remember to do when opening a piece of equipment?**

Listening

6 **Listen to a conversation between a technician and an apprentice. Mark the following statements as true (T) or false (F).**

1 _ The woman forgot to remove all the panels.
2 _ There is a screw under one of the labels.
3 _ The woman is going to look for instructions online.

7 **Listen again and complete the conversation.**

Apprentice:	Can you help me? I'm having problems **1** ______ this laptop.
Technician:	Let me see. Did you remember to **2** ______ it from the power source?
Apprentice:	Yes, I've done that.
Technician:	Great. And have you removed all the **3** ______?
Apprentice:	Yes, I have. And I've removed all the screws I can find, but the case still won't **4** ______ ______.
Technician:	Don't forget to check under the **5** ______. There may be a screw there.
Apprentice:	Well, I can't feel any screws.
Technician:	Why don't you peel them back and check? You can stick them down again later with **6** ______.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

I'm having problems ...
Did you remember to ...
There could be ...

Student A: You are a technician. Talk to Student B about
- what to do before opening an electronic device
- removing panels
- finding information

Student B: You are an apprentice. Talk to Student A about how to open a device.

Writing

9 **Use the trade magazine and the conversation from Task 8 to write about opening an electronic device. Include what needs to be done before opening the case, what needs to be removed, and how to find more information.**

Removing components

In the past it was simple to remove components. Circuits had one layer. You just had to remove the solder and pull the lead through the hole in the board. Nowadays, boards are **multi-layered**, and component removal requires lots of skill and patience.

First, **double-check** that you have disconnected the power source. Then, **clear** the solder from the hole using a soldering iron and solder wick. Heat the solder. The **molten** solder will **flow** into the wick. Then you can pull the lead through. For large pieces, **suck** the solder away using a solder sucker. This may leave a **coating** of solder. Remove this using wick.

Some parts of the circuit are made of copper, which absorbs heat. **Thermal absorption** makes it hard to melt solder. The thick, **multi-layered** boards also produce a **heat-sinking** effect. If you can't melt the solder, don't use a higher wattage iron. This can **deform** the boards and damage the circuit lands. It can also **delaminate** multi-layered circuit board lands and some components' pads.

If you can't remove all the solder, **clip** the leads close to the components. Then you can solder the new component to the old component's leads. If you can't reach the leads, **chop off** the component close to its base.

Get ready!

1 Before you read the passage, talk about these questions.

1 What are some ways a circuit board can be damaged by heat?

2 What are two ways to disconnect leads or wires?

Reading

2 Read the article on removing components. Then, mark the following statements as true (T) or false (F).

1 __ Solder wick is used to remove small pieces of solder.

2 __ A higher wattage iron is good to use on multi-layered boards.

3 __ Remove the solder before cutting the component leads.

Vocabulary

3 Match the words (1-8) with the definitions (A-H).

1 __ flow

2 __ deform

3 __ delaminate

4 __ chop off

5 __ suck

6 __ double-check

7 __ clear

8 __ clip

A check something twice

B remove obstacles from a passage

C remove the coating

D cut through something small and thin

E remove using a vacuum

F move in liquid form

G change shape in a bad way

H cut and remove something

4 Write a word that is similar in meaning to the underlined part.

1 These days most circuit boards are made of several boards on top of each other.
m _ _ _ _ - _ a _ _ r _ _
2 The fact that some parts take away the heat often makes it hard to melt solder.
_ h _ _ _ _ l   _ b _ _ _ _ _ i _ _
3 The thickness of the boards creates a fast cooling effect.   h _ _ _ - _ _ n _ _ _ g
4 You can remove the lead once the solder is hot and in liquid form.   _ _ l _ _ n
5 You don't need to add a thick layer of paint. A thin layer is enough.   _ o _ _ _ n _

5 Listen and read the article again. How do you remove components from a multi-layered board?

Listening

6 Listen to a conversation between two technicians. Mark the following statements as true (T) or false (F).

1 __ The woman is using a solder sucker.
2 __ The man and woman decide to use a higher-wattage iron.
3 __ The man suggests clipping the wires.

7 Listen again and complete the conversation.

Tech 1: Can you help me? I can't remove this 1 ______.
Tech 2: Sure. Removing pieces from 2 ______ - ______ ______ is really difficult.
Tech 1: I know. I can't 3 ______ ______ ______.
Tech 2: What are you using?
Tech 1: A soldering iron and wick. But the solder isn't melting, so it won't 4 ______ ______ the wick.
Tech 2: Maybe the iron isn't hot enough.
Tech 1: The iron is hot, but the thermal absorption from the copper parts is producing a 5 ______ - ______ ______.
Tech 2: You could try using a higher wattage iron.
Tech 1: No, I don't think we should do that. We could 6 ______ ______ ______.

Speaking

8 With a partner, act out the roles below based on Task 7. Then switch roles.

USE LANGUAGE SUCH AS:

I can't remove this ...
You could try ...
No, I don't think ...

Student A: You are a technician. Talk to Student B about:
- clearing the hole
- the equipment you are using
- other methods of removing the component

Student B: You are a technician. Talk to Student A about how to remove a component.

Writing

9 Use the article on removing components and the conversation from Task 8 to write a memo about the proper way to remove components. Include what type of equipment to use, what equipment shouldn't be used, and when to clip wires.

Using the Right Components

Replacing components in your electrical device can be tricky. Following a couple of basic rules helps ensure you get the right component.

Get ready!

1 Before you read the passage, talk about these questions.

1 Where can techs sometimes find the components they need?

2 What can techs do with similar components?

Reading

2 Read the column on choosing components. Then, choose the correct answers.

1 What is the purpose of the article?

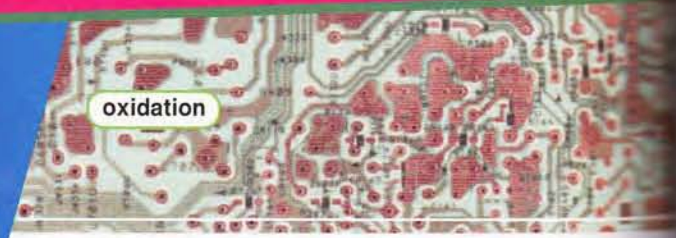
- A to explain how to substitute components
- B to explain how to buy mail-order components
- C to discuss how to reuse components
- D to give advice about choosing components

2 What does a component need to be in order to substitute for another?

- A reusable
- B similar
- C specified
- D standardized

3 What is NOT a method of getting a component?

- A through the mail
- B in a stockpile
- C in an application
- D substituting a component



1 Know What Component You Need Before Buying

Before ordering a new component, make sure you really need one. You may have an unused electrical device that has the component you need. You may be able to **substitute** one of these components for the one you require. But make sure the components are **similar** enough that they can be substituted. You don't want to damage your device by using the wrong component. Some components can only be used for specified **applications**.

2 Be Smart and Consider All Your Options

First, be careful if you're going to get a **mail-ordered** component. You will want to do some research to make sure that you are actually ordering the right product. It is best to only order **standardized** products when buying stock unseen. You may also be a person who **builds up** little **stockpiles**. All the necessary components may be there and in good working order. Some components can last a very long time. It may be possible to **reuse** a component if it is still in good condition. Before reusing any item, look for signs of damage or **oxidation**.

Vocabulary

3 Match the words (1-7) with the definitions (A-G).

1 __ substitute
2 __ application
3 __ consider
4 __ mail-ordered
5 __ standardized
6 __ oxidation
7 __ build up

- A to replace one object with a different object
- B never changing
- C to gradually collect something
- D a purpose for which something is used
- E to think about something
- F process in which oxygen accumulates
- G something that comes in the mail

4 **Fill in the blanks with the correct words from the word bank.**

word BANK

reuse substitute similar stockpile

1 The computer monitor was in good condition, so I decided to ________ it.
2 Here, this is a good ________ for that component.
3 The computer keyboards are very ________ to each other.
4 I have accumulated a ________ of unused regulator components.

5 **Listen and read the column again. Why is it important to use components properly?**

Listening

6 **Listen to a conversation between a new technician and an experienced technician. Mark the following statements as true (T) or false (F).**

1 __ The woman is working on a computer.
2 __ Extra keyboards are kept in the basement.
3 __ The man suggests checking the stockpile for a keyboard.

7 **Listen again and complete the conversation.**

New Tech: Excuse me, Jack. I'm **1** ______ ______ ______ you while you're working, but I have a question.
Experienced Tech: That's okay. What do you need?
New Tech: I'm working on this computer. **2** ______ ______ ______ where I can find a keyboard for it?
Experienced Tech: We normally keep them in the storage closet.
New Tech: I already checked there but I didn't find any. Could they be somewhere else?
Experienced Tech: No. If they're not in there then **3** ______ ______ ______ have anymore.
New Tech: What should I do?
Experienced Tech: We have a whole **4** ______ ______ ______ machines downstairs. I think there are a few keyboards there.
New Tech: Will one of those work?
Experienced Tech: Yes. There's **5** ______ ______ with them. We just couldn't use the actual computers anymore.
New Tech: Okay, well I'll **6** ______ ______ ______.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

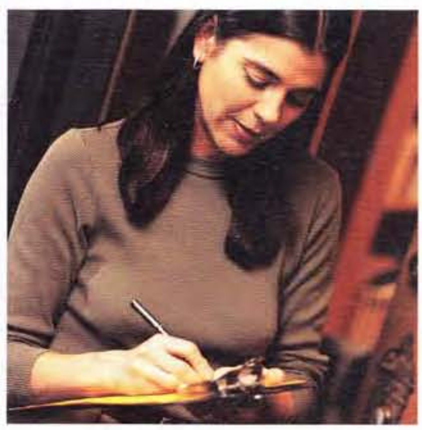
What do you ...
I have ...
Are you ...

Student A: You are a new technician. Talk to Student B about:
- helping with something
- fixing an electronic device
- finding a part for the device

Student B: You are an experienced technician. Talk to Student A about finding a replacement component for an electronic device.

Writing

9 **Use the column on choosing components and the conversation from Task 8 to complete the new tech's email to the experienced tech thanking him or her for helping locate a component. Include what component was needed, where it was found, and a benefit of reusing components.**



6 Power supply

Get ready!

1 Before you read the passage, talk about these questions.

1 What does every electronic device need?
2 Inductors are often what shape?

Reading

2 Read the text excerpt. Then, mark the following statements as true (T) or false (F).

1 __ A regulation system manages voltage.
2 __ Inductors and transformers have square cores.
3 __ A voltage inverter looks similar to a line filter.

Vocabulary

3 Place the words and phrases from the word bank under the correct heading.

Word BANK

filter round linear supply
switching supply toroid square

Shapes	Power	Component
___________	___________	___________
___________	___________	___________
___________	___________	___________

Introduction to Electronics 62

Power Supply

Every electronic device needs some kind of **power supply**. An obvious example is a battery. In some instances a **regulation system** is also needed to keep the voltage constant. If you need to find a device's regulation system, keep an eye out for **inductors** and transformers. They are generally made from a dark, matte metal. They can be **round** or **square** and often have **toroid** cores. You could also try to spot the electrolytic capacitors. They are usually **congregated** near the power supply area.
Nowadays, power switches have been replaced by transistor switching. **Microprocessors** control transistor switching. This method is also used in some AC-powered devices. However, other such devices use **hard switches**. **Switching supplies** are now the norm, except with some audio products that continue to use **linear power supplies**.
If you look inside a switcher, you will notice that the AC line travels through a line **filter**. From there, it passes through many different parts before reaching the electrolytic filter caps. It is common for people to confuse the switching supply components with a **voltage inverter**. The latter resembles small switching supplies. However its job is to convert low voltage to high voltage.

4 Write a word that is similar in meaning to the underlined part.

1 The computer contains a(n) <u>electronic device that allows it to work</u>.
_ _ c _ o _ r _ _ e _ s o _
2 The components were <u>gathered together</u> near the power supply. _ o _ g _ e _ _ t _ d
3 The <u>system that keeps voltage constant</u> was broken. _ e _ u _ _ t _ _ n _ y _ _ e m
4 The product used a battery as a <u>means of providing electrical energy</u>.
_ _ w _ r _ u _ p _ y
5 The tech used a(n) <u>power supply that increases voltage</u>. _ _ l t _ _ e _ n _ e _ _ e r
6 The two devices use <u>switches that cut off load current in a particular amount of time while handling high voltage and current</u>.
_ a _ d _ w _ t _ h _ s

5 Listen and read the textbook excerpt again. What does a voltage inverter do?

Listening

6 Listen to a conversation between an experienced tech and a new tech. Choose the correct answers.

1 What is a characteristic of an inductor?

A It is battery powered.

B It is made from metal.

C It is connected to a fuse.

D It is linear in shape.

2 What will the man and woman most likely do next?

A find the line filter

B start the inductor

C look at linear supplies

D fix the rectifier

7 Listen again and complete the conversation.

Experienced Tech:	Okay, so today I'm going to show you how to locate **1** ______ ______. First, we'll deal with battery-powered products.
New Tech:	Great.
Experienced Tech:	Now, if you want to find the **2** ______ ______, you need to search for transformers or inductors.
New Tech:	How will I know if I find them?
Experienced Tech:	Usually, you'll be able to tell because they are made from **3** ______, ______ ______.
New Tech:	What shape are they?
Experienced Tech:	They can be round or square in shape. But the **4** ______ ______ is pretty distinctive.
New Tech:	**5** ______ ______ ______ I don't know what toroid means.
Experienced Tech:	No problem. I'd rather you asked, than wondered! A toroid core will look **6** ______ ______ ______.

Speaking

8 With a partner, act out the roles below based on Task 7. Then switch roles.

USE LANGUAGE SUCH AS:

Are we looking ...

What does ...

Most products ...

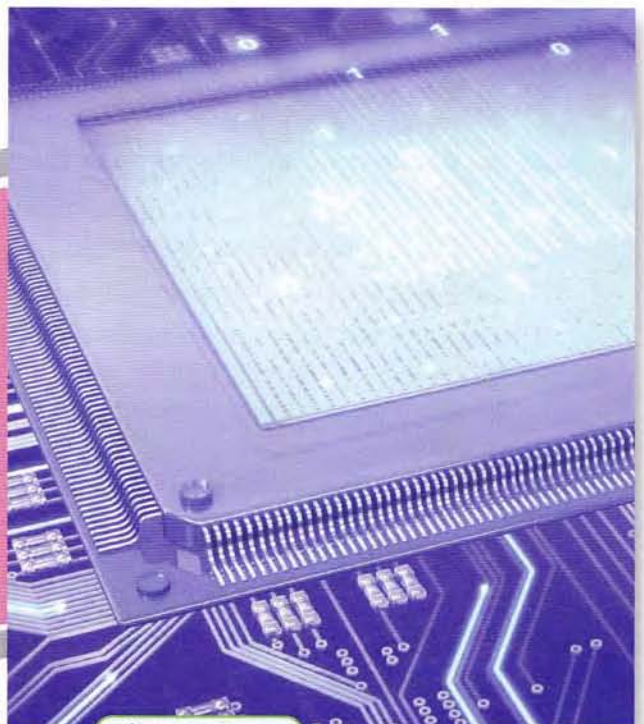
Student A: You are an experienced tech. Talk to Student B about:

- switches
- power supplies
- voltage inverters

Student B: You are a new tech. Talk to Student A about switches and power supplies.

Writing

9 Use the text excerpt and the conversation from Task 8 to fill out the new tech's notes on power supplies. Include information on switches, the jobs they do, and different power supplies.



microprocessor

7 Input/Output

Get ready!

1 Before you read the passage, talk about these questions.

1 How are radio signals usually picked up?

2 What is an example of a transducer?

Reading

2 Read the online article. Then, choose the correct answers.

1 What can you infer about televisions?

A Televisions use input jacks to amplify signals.

B Televisions can receive more types of input than radio.

C Televisions are not compatible with variable capacitors.

D Television output is controlled by a motor.

2 What do analog tuners use to amplify signals?

A a varactor C a display

B a transducer D a capacitor

3 Which of the following is NOT a type of input?

A coil C antenna

B S-video D composite

How does that work?

All About Input Output

One of the **input** section's jobs is to **collect** signals. After that it **feeds** the signals to the processing section. With radio and TV equipment, the input can be via **cable** or **antenna**. In addition, televisions can receive baseband video, such as **composite** and S-video. Input can also come from a **transducer**, like a microphone. If you ever need to access the video input circuitry, just follow the lines from the **input jacks**.

The input section is responsible for the **amplification** of the signals. The typical method of accomplishing this uses coils that **resonate** at a specific frequency. Analog and digital tuners amplify signals using different techniques. With analog tuning, a mechanically variable capacitor alters the frequency. In digital tuning, this is achieved by the **varactor**.

Output stages ready the signal for **display**, or for its end purpose. This is done through current amplification. This gives a signal the power to do things like driving an **audio** speaker or operating a motor. If you ever need to find the output stages, they are easy to spot. They are almost always bigger than the surrounding components.

Vocabulary

3 Fill in the blanks with the correct words from the word bank.

Word BANK

amplification cable composite input feeds transducer

1 The input section __________ the signals to the processing section.

2 A __________ is a plastic covered wire that conveys signals.

3 The tech used a __________ to change the power, so that other equipment could use it.

4 Current __________ occurs during output stages.

5 Cable and antenna are different types of __________.

6 __________ is a kind of baseband video.

4 Read the sentence pair. Choose where the words best fit the blanks.

1 **display / audio**

A The tech fixed the ___________ and sound blared from the speaker.

B Output stages prepare a signal for its end purpose, such as ___________.

2 **resonated / connected**

A The tuning fork ___________, filling the room with sound.

B The tech ___________ the two wires together, completing the circuit.

3 **antenna / output**

A The television ___________ was broken and could not receive signals.

B ___________ is anything that is produced by a system.

4 **input jack / varactor**

A The ___________ helps to control tuning.

B The ___________ receives audio signals.

5 Listen and read the online article again. How would you find the video input circuitry?

Listening

6 Listen to a conversation between a customer and a tech. Mark the following statements as true (T) or false (F).

1 __ The man thinks there is a problem with the antenna.

2 __ The television cannot receive signals properly.

3 __ The television needs a power supply to work.

7 Listen again and complete the conversation.

Customer: Do you know **1** ______ ______ with my television? I've had it for years and it's never given me any problems before. I don't understand why it's suddenly stopped working.

Tech: This television is quite old. It still has an antenna. In fact, I think the antenna may be the problem.

Customer: Really? How so?

Tech: It looks like the antenna might be damaged. That causes **2** ______ ______ ______.

Customer: I don't understand what that means.

Tech: Basically, the television needs to receive signals. If the antenna is damaged, the television can't get the signals.

Customer: I always thought the TV just needed a **3** ______ ______.

Tech: Well, you're right **4** ______ ______ ______ ______ the TV won't work without a power supply. But it needs to collect signals as well.

Customer: Technology is **5** ______ ______ these days.

Tech: You don't have to **6** ______ ______!

Speaking

8 With a partner, act out the roles below based on Task 7. Then switch roles.

USE LANGUAGE SUCH AS:

I don't understand ... / There must be ...

So can you ...

Student A: You are a customer in an electronics repair store. Talk to Student B about:

- why the television is not working
- the likely problem
- how output works

Student B: You are a tech in an electronics repair store. Talk to Student A about repairing the television.

Writing

9 Use the online article and the conversation from Task 8 to fill out a repair report. Include information on what kind of device needed repair, what the problem was, and how it was fixed.

8 Signal processing

Get ready!

1 Before you read the passage, talk about these questions.

1 How do you search for a radio signal?

2 How do electronic devices alter sounds?

Work Order Number: 254771

Repair Item: An older model stereo system with radio, CD, and cassette components.
Location: The stereo was dropped off at the Front St. branch. It has been **sent** to the main repair center.

Time Parameters: The client is hosting a party on Wednesday. She will need to use the stereo for this event. The repair must be completed by Wednesday morning, at the latest.

Assessment: The stereo **combines** analog and digital functions. The CD player effectively **converts** digital signals to analog ones for output. The cassette player is able to **record** and **play back** music without incident. However, the radio seems to have a hard time **taking in** and **processing** signals. As a result, reception is extremely poor. The radio's **tuning** appears to be in good working order. The radio can **synthesize** sounds and signals appropriately.

Action Taken: I opened up the radio and looked at the **small-scale** components. After a full examination, I concluded that the radio could not **retrieve** signals. All the interior components were in good shape. But the antenna was damaged. I replaced the antenna with a new one.

Outcome: The client will pick it up tomorrow before 10am.

Reading

2 Read the work order. Then, choose the correct answers.

1 What is the work order mostly about?

A ordering a new CD player
B building a custom radio
C playing music for a party
D repairing a broken stereo

2 Which part of the product is NOT working?

A the antenna
B the tuning
C the cassette player
D interior components

3 Why does the customer need the item back by Wednesday morning?

A She is trading it in for a newer model.
B She is going to take it to another repair shop.
C She is hosting a party that night.
D A client is coming to pick it up from her.

Vocabulary

3 Match the words (1-6) with the definitions (A-F).

1 __ convert
2 __ parameters
3 __ process
4 __ small-scale
5 __ take in
6 __ tuning

A a set of limits determining how something should be done
B having a lesser size than other similar objects
C the act of setting a radio or TV to receive a certain program
D to change one thing into something else
E to receive information
F to use electronic equipment to organize information

4 **Read the sentence pair. Choose where the words best fit the blanks.**

1 **record / retrieve**

A The man wanted to __________ the conversation so he could listen to it again later.

B The electronic device was broken and so could not __________ the signal.

2 **played back / combined**

A The device __________ both analog and digital functions.

B The woman __________ the home movie on her camcorder.

3 **synthesize / send**

A The woman used her cell phone to __________ a text message.

B The man wants to __________ the music, so that it sounds better.

5 **Listen and read the work order again. What action did the tech take?**

Listening

6 **Listen to a conversation between an experienced tech and a new tech. Mark the following statements as true (T) or false (F).**

1 __ The radio is having power supply problems.

2 __ The woman suggests the man overlooked a damaged component.

3 __ The man repairs the old antenna.

7 **Listen again and complete the conversation.**

New Tech: Can you help me with this radio? I don't know what's **1** ______ ______ ______.

Experienced Tech: Okay. What type of issue did the client report?

New Tech: Just that the sound wasn't right.

Experienced Tech: Oh, that's not very specific. Maybe it's the **2** ______ ______.

New Tech: The tuning seems fine. I don't think that's what's wrong with it.

Experienced Tech: Have you opened it up yet? There could be a problem with one of the **3** ______ ______ that's preventing the radio from processing signals.

New Tech: I already had **4** ______ ______ ______. Everything seemed okay.

Experienced Tech: Are you sure you examined every component? It's easy to **5** ______ one. They're so tiny.

New Tech: I'm pretty certain I didn't **6** ______ ______.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

What type of ...

Have you looked ...

That must be ...

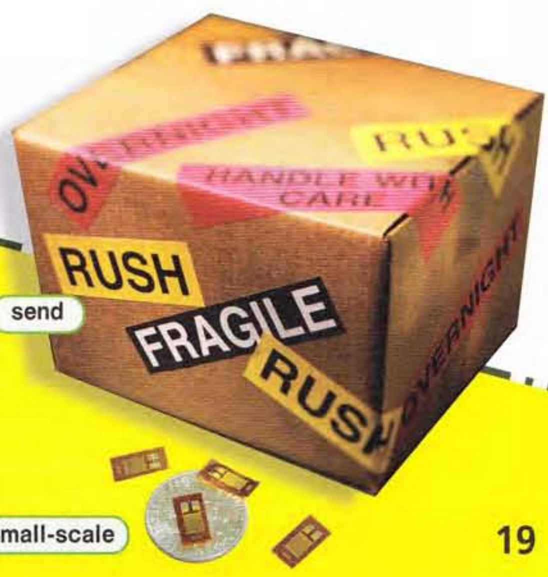
Student A: You are an experienced tech. Talk to Student B about:

- the device
- possible problems
- solutions

Student B: You are a new tech. Talk to Student A about repairing the device.

Writing

9 **Use the work order and the conversation from Task 8 to fill out the step-by-step guidelines for repair center employees. Include what the problem with the device is, the steps taken to discover the problem and what was done to fix the problem.**



send

small-scale

9 Heat sinks

Get ready!

1 Before you read the passage, talk about these questions.

1 What are two types of heat sink?
2 What materials are heat sinks usually made from?

Heat Sinks

Any electronics hobbyist will eventually have issues with heat. Modern computers run at **speeds** that were unimaginable to previous generations. In fact, we commonly run many programs simultaneously. This generates heat. It is critical to prevent your processor from **overheating**. Overheating can ruin your whole system and necessitate expensive repairs. That's where heat sinks come in. Heat sinks are **attachments** that **cool down** your processor by dissipating heat.

Heat sinks are usually made from **aluminum** or **copper**. Aluminum is cheap and lightweight. Copper is better at removing heat, but is heavier and more expensive. Both metals act as **thermal conductors** and **draw away** heat from the central processing unit. This is achieved by using a **case fan** to create **airflow**. The job of a case fan is to take cool air from outside the computer. That air travels through the computer, removing hot air from the rear. There are two main types of heat sinks: **passive heat sinks** and **active heat sinks**. The former uses a large fan to dissipate thermal heat. The latter have fans above the processor to help with the cooling process. If the electronics equipment you built is overheating, consider investing in one of these heat sinks.

Reading

2 Read the magazine article. Then, choose the correct answers.

1 What is the purpose of the article?
  A to analyze the various speeds of heat sinks
  B to compare different models of heat sinks
  C to explain why computers need heat sinks
  D to discuss aluminum versus copper heat sinks

2 Which of the following is NOT a fact about heat sinks?
  A Heat sinks are a type of processor.
  B Heat sinks act as thermal conductors.
  C Heat sinks use one or two fans.
  D Heat sinks work by creating airflow.

3 According to the article, what creates heat?
  A adding computer attachments
  B running several programs at once
  C using a cheap computer processor
  D removing the thermal conductor

Vocabulary

3 Fill in the blanks with the correct words and phrases from the word bank.

Word BANK

active heat sink attachment
case fan draw away
passive heat sink
speeds thermal conductor

1 The ________________ blows cool air through the computer.
2 Nowadays, computers run at very high ________________.
3 Aluminum acts as a ________________ and moves heat away from the CPU.
4 A ________________ has only one fan.
5 The job of a heat sink is to ________________ heat.
6 The ________________ has two fans.
7 A heat sink is a kind of ________________.

4 **Read the sentence pair. Choose where the words best fit the blanks.**

1 **cool down / overheat**

A No one wants their computer to ___________ because it causes a lot of damage.

B The man bought a heat sink because he wants to ___________ his processor.

2 **airflow / aluminum**

A Soda cans and foil are often made from ___________.

B The fan created a(n) ___________, which cooled down the processor.

3 **copper / heat sink**

A ___________ is a metal that is commonly used for pipes and wiring.

B The tech thought there might be a problem with the ___________ because the computer overheated.

5 **Listen and read the magazine article again. Why are heat sinks usually made from copper or aluminum?**

Listening

6 **Listen to a conversation between a tech and a customer. Mark the following statements as true (T) or false (F).**

1 __ The woman failed to install a heat sink.

2 __ The man recommends a passive heat sink.

3 __ The woman wants to buy the recommended product.

7 **Listen again and complete the conversation.**

Tech:	How can I help you today?
Customer:	Actually, I wanted 1 ______ ______. I've been building my own computer but I've encountered a problem.
Tech:	What kind of problem?
Customer:	My processor 2 ______ ______. Do you know what is causing that to happen?
Tech:	Well, computers do overheat fairly easily. Did you install a 3 ______ ______?
Customer:	Yes, I did. But it doesn't seem to be working. Can you tell me where I'm 4 ______ ______?
Tech:	Are you using a passive heat sink?
Customer:	Yes, I am. Is that a mistake?
Tech:	Passive heat sinks are fine. But your processor may be producing too much heat for it to handle. 5 ______ ______ ______ using an active heat sink?
Customer:	No, what's the difference between the two?
Tech:	Passive heat sinks have a 6 ______ ______ ______ that allows the heat to disperse. But they're mostly intended for processors that don't produce a lot of heat.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

Actually, I wanted ... / What kind ...

How fast ...

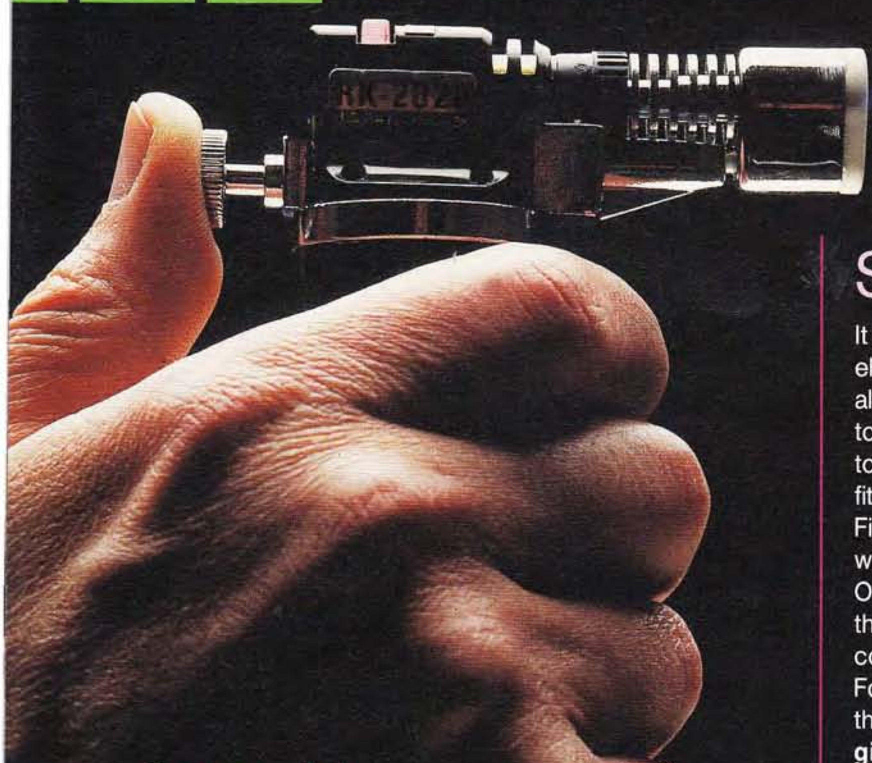
Student A: You are a tech. Talk to Student B about:
- the computer
- passive heat sinks
- active heat sinks

Student B: You are a customer. Talk to Student A about your computer problem.

Writing

9 **Use the magazine article and the conversation from Task 8 to write an information pamphlet about heat sinks. Include information about why heat sinks are important, passive heat sinks and active heat sinks.**

10 Separating the snaps



Get ready!

1 Before you read the passage, talk about these questions.

1 How do you open a device that has snaps?

2 What is one way of resealing any gaps in a device after it has been repaired?

Separating the Snaps

It might be **necessary** to **unhook** the **snaps** on your electronic device in order to repair it. Snaps are not always **visible** from the outside of the item. The first thing to do is to unscrew all of the screws. The simplest way to release the snaps is to use **slots**. The screwdriver will fit into the slots and **pop** open the snaps easily.

First, look in the slots with a flashlight to **figure out** which part needs to be pushed to unhook the snap. Once a snap is popped open, pull the two **halves** of the item apart. Continue with the rest of the snaps until completed.

For devices that do not have slots, find the **seam** on the side of the item. Press on the seam until the plastic **gives**. If one spot does not move, try another one. Keep pressing until the snap is released and repeat until finished.

If the snaps won't separate, try to **pry** open the item with a screwdriver. Only attempt this if the above directions do not work. This is considered a last option because it will likely break some of the snaps. A broken snap can leave a **gap** in the seam of the item. Save the broken pieces to **melt** together any gaps if necessary.

Reading

2 Read the electronics manual excerpt. Then, choose the correct answers.

1 What is the main idea of this passage?
- A how to close a gap
- B how to separate snaps
- C how to repair electronics
- D how to pry open an item

2 Which of the following is NOT discussed in the passage?
- A different ways to separate snaps
- B the way to open a snap with a slot
- C the best way to utilize gaps
- D where to press the plastic

3 According to the article, what should be the last option for separating snaps?
- A prying it open
- B using the slots
- C pressing the seam
- D melting the snap

Vocabulary

3 Match the words (1-8) with the definitions (A-H).

1 __ slot
2 __ snap
3 __ pop
4 __ seam
5 __ necessary
6 __ visible
7 __ gap
8 __ half

A a fastener that locks with a click
B one of two equal parts of something
C absolutely required
D an opening in a solid structure
E a narrow opening where something is to be inserted
F to open something
G able to be seen by the eye
H the line where two pieces of material meet

4 **Read the sentence pair. Choose where the words best fit the blanks.**

1 **gives / melts**

A You can open the seam easier if the plastic ___________ a little.

B After the plastic ___________, it can be re-shaped.

2 **unhook / pry**

A You'll have to ___________ that open because it won't open on its own.

B Try to ___________ the snap without using the screwdriver.

3 **melted / figured out**

A Susan ___________ the plastic so that she could use it again.

B Mitchell ___________ how to separate the snaps without a screwdriver.

5 **Listen and read the electronics manual excerpt again. How do you open cases that do not contain slots?**

Listening

6 **Listen to a conversation between a customer and an employee. Mark the following statements as true (T) or false (F).**

1 __ The woman needs help with separating the snaps.

2 __ The woman found slots on the bottom of the item.

3 __ The man suggests prying the item open.

7 **Listen again and complete the conversation.**

Employee: Please look to see if there are any **1** ______ ______ ______ ______ of the item.

Customer: I don't see any. Can I still **2** ______ ______ ______ ______?

Employee: Yes, don't worry. Find the **3** ______ ______ ______ ______ of the item.

Customer: Okay, I found it. Now what do I do?

Employee: Feel around slowly for **4** ______ ______ underneath and push there.

Customer: Okay, the plastic is starting to **5** ______ ______ ______.

Employee: That's great. Now press it harder and try to lift up the seam.

Customer: Oh, **6** ______ ______! The snaps are open!

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

The first thing ...

Find the ... of the item.

Get a ...

Student A: You are a customer service employee for an electronics manufacturer. Talk to Student B about:

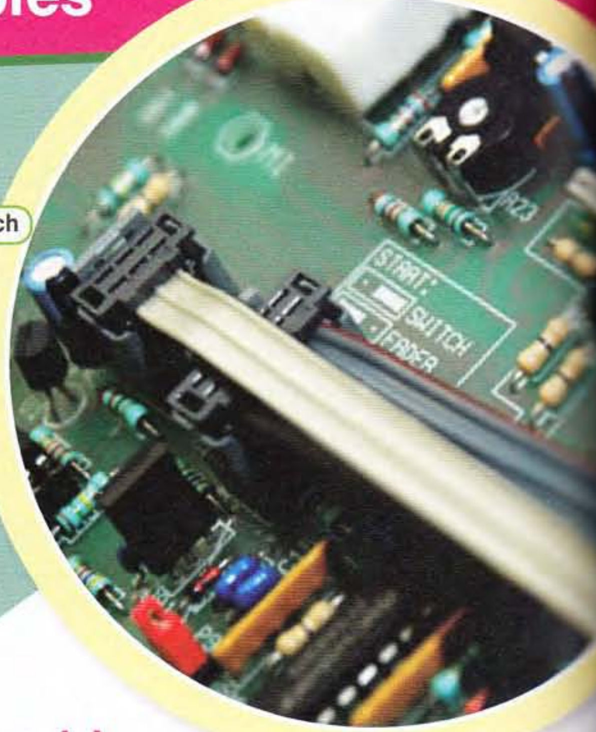
- unscrewing the screws
- looking for slots
- finding the seam and pressing

Student B: You are a customer. Talk to Student A about how to get the snaps open on your item.

Writing

9 **Use the electronics manual excerpt and the conversation from Task 8 to write instructions on how to separate snaps. Include suggestions and steps to follow to help get snaps open.**

11 Removing ribbon cables



How to Remove Ribbons

Ribbon cables are wide and flat, with many wires running **parallel** to each other on the same flat plane. They are very **delicate** and **complex** pieces of electronic equipment. So, if you need to remove one, you must be extremely careful. To remove a ribbon cable take the following steps:

First, draw a small line on the cable with a **permanent marker**. Do the same thing on the socket. This will help you remember exactly where the ribbon cable goes.

Next, study the connection. Most of the time, there are **latches** at the end of ribbon cables. These latches connect the conductor to its **socket**. If the cable has a latch, there will be **reinforced tabs** on the socket. Always make sure to unfasten a latch before tugging on a cable. If you don't, you may destroy the cable or it could become **crooked**. And because they are **custom made**, cables are usually impossible to replace.

How you should unfasten the latch depends on the type of latch. For a **slide latch**, pull on both tabs at once. For a **flip-up latch**, grab the edge of both tabs and lift them up together very gently.

However, some ribbons don't have latches. In this case, grab the tabs on the end of the cable. Then, carefully tug on them.

Get ready!

1 Before you read the passage, talk about these questions.

1 What does a ribbon cable latch attach to?

2 What can electronics technicians use to mark things while they work?

Reading

2 Read the instructions. Then, mark the following statements as true (T) or false (F).

1 __ Use a pencil to mark a ribbon.

2 __ Open latches before pulling cables out.

3 __ All ribbon cables have latches.

Vocabulary

3 Match the words (1-7) with the definitions (A-G).

1 __ delicate

2 __ tab

3 __ complex

4 __ parallel

5 __ latch

6 __ custom made

7 __ ribbon cable

A being complicated

B a cable containing many wires

C a fastener or connecter

D running beside each other

E being specially designed

F a tag or flap

G being fragile

4 **Read the sentence pair. Choose where the words best fit the blanks.**

1 **crooked / reinforced**
 A The wire is __________, not straight.
 B The building is __________ with steel beams.

2 **flip-up latch / slide latch**
 A Open a __________ by pulling on two tabs.
 B Open a __________ by lifting the two tabs.

3 **socket / permanent marker**
 A Please label it with a __________.
 B The plug fits into the __________.

5 **Listen and read the instructions again. Why should a technician write on a socket and ribbon before removing it?**

Listening

6 **Listen to a conversation between two technicians. Choose the correct answers.**

1 What does the man need help with?
 A locating the slide latch
 B marking the cable with a marker
 C connecting the cable to a socket
 D removing a ribbon cable

2 What does the woman suggest writing on?
 A the tab
 B the socket
 C the slide latch
 D the marker

7 **Listen again and complete the conversation.**

Tech 2: What kind of **1** ______ is it?
Tech 1: It looks like a **2** ______ ______.
Tech 2: Okay. To open a slide latch, you need to pull on both tabs at once.
Tech 1: Oh, this makes me so **3** ______? What if I break the cable?
Tech 2: Don't worry. You're **4** ______ ______! Just be very gentle.
Tech 1: I did it! Now, I just pull the cable carefully out of the **5** ______, right?
Tech 2: **6** ______ ______! And then you're done.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

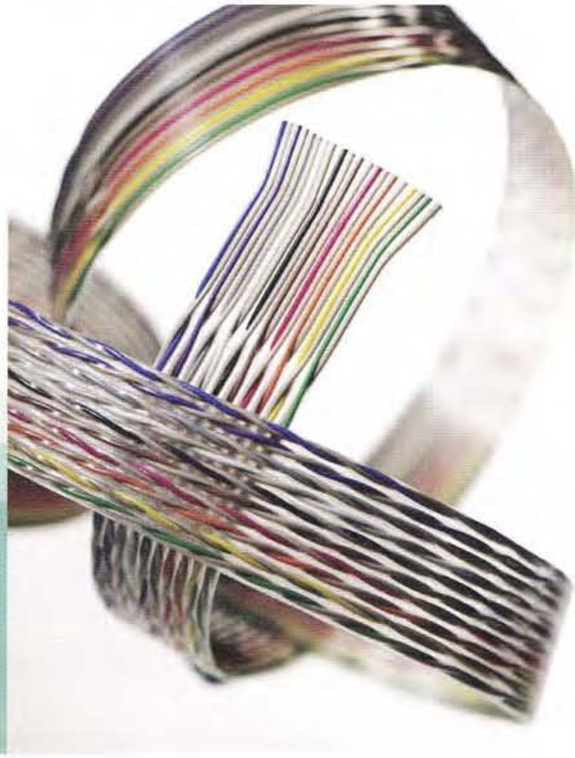
Now, find the ...
What kind ...
Don't worry.

Student A: You are an experienced technician. Talk to Student B about:
- what he or she needs to do
- working calmly and carefully
- doing a good job

Student B: You are an inexperienced technician. Talk to Student A about how to remove a ribbon cable.

Writing

9 **Use the instructions and the conversation from Task 8 to create an instruction sheet for removing ribbon cables. Include the steps for removing ribbons and how to unfasten the different kinds of latches.**



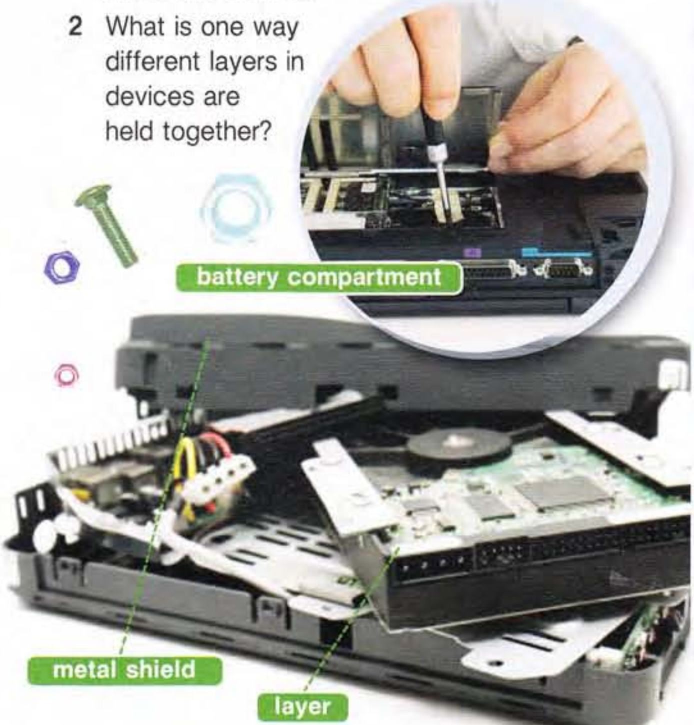
12 Layers

Get ready!

1 Before you read the passage, talk about these questions.

1 What are some layers that might be in an electronic device?

2 What is one way different layers in devices are held together?



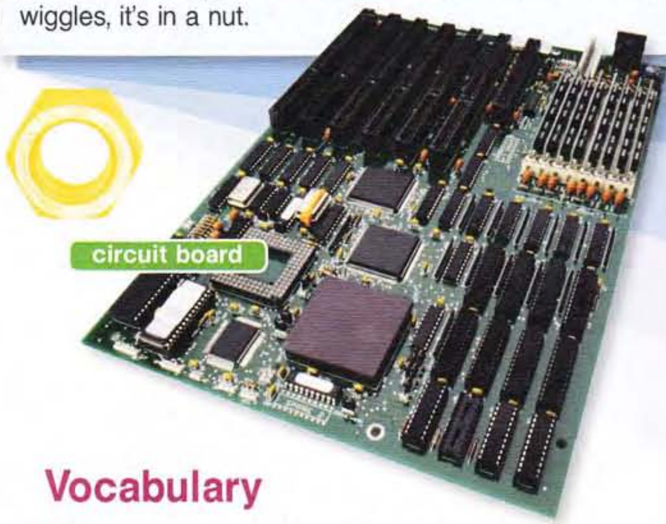
Electronic Device Layers

Electronic devices today are incredibly complex. Normally, they are designed with multiple **layers**. These layers are **stacked** on top of one another. For example, the first layer is the screen. Next comes a **metal shield**. Under that layer, there may be a **circuit board**. Another layer of some sort is usually underneath the circuit board. Finally, the last layer may contain the **battery compartment**.

With so many layers, it is difficult to repair devices. Technicians must take the layers off very **precisely**. They should also draw the device schematic on a piece of **drawing paper**. Otherwise, they might **lose track** of where all the parts go.

In almost all devices, screws keep the layers together. To fix a device, some screws must be taken out. Technicians can remove any screw twisted into a **fixed** part of the device. They should not remove screws in nuts, though. It is too easy to lose **nuts** somewhere inside the device.

Unfortunately, technicians won't always know which screws are which. Some devices have arrows indicating the screws that can be removed. However, this isn't an **industry standard**. Most of the time, technicians must just start unscrewing screws **counterclockwise**. If a screw wiggles, it's in a nut.



2 Read the textbook excerpt. Then, choose the correct answers.

1 What is the purpose of the passage?
- A to persuade readers to buy devices with layers
- B to inform readers how to use nuts and screws
- C to explain layers in electronics devices
- D to compare different layers in devices

2 What screws should technicians remove?
- A screws twisted into nuts
- B screws twisted into fixed objects
- C all screws in the device
- D screws not marked with arrows

3 What is NOT mentioned in the passage?
- A one layer of a device is usually a metal shield
- B technicians should list a layer's parts on scrap paper
- C arrows next to screws are not an industry standard
- D unscrew screws by twisting them clockwise

Vocabulary

3 Place the words and phrases from the word bank under the correct heading.

Word BANK

circuit board fixed
counterclockwise metal shield
nuts battery compartment

Device layers	Words related to screws
______________	______________
______________	______________
______________	______________

4 Read the sentence and choose the correct word.

1 The next **layer / metal shield** is the circuit board.
2 Just **lose track / stack** those discs in the corner.
3 He wrote his phone number on **scrap paper / nut**.
4 Don't **stack / lose track** of that wire.
5 The device meets **industry standards / battery compartments**.
6 Please do the job very **counterclockwise / precisely**.

5 Listen and read the textbook excerpt again. What do arrows near screws mean in layered electronics?

Listening

6 Listen to a conversation between an instructor and a student. Mark the following statements as true (T) or false (F).

1 __ The woman has troubling telling the difference between screws.
2 __ There were no arrows on the first layer.
3 __ Screws without arrows should be removed.

7 Listen again and complete the conversation.

Instructor: Remember, class, that you must work very precisely when you take the **1** ______ ______.

Student: Mr. Harrison, I have a question. I've taken the first layer off. Should I take this **2** ______ ______ ______?

Instructor: Okay, Shirley. Let me see ... No. No, that's not how you want to do it.

Student: Why not? I thought I needed to take it out to get to the **3** ______ ______.

Instructor: Well, if you take that screw out, you'll probably **4** ______ ______ ______.

Student: Oh. How did you know that? All the screws **5** ______ ______ ______ to me!

Instructor: Do you see **6** ______ ______ next to the screw?

Student: Yes. I saw those on the first layer too.

Instructor: This means that you should take the screw out.

Speaking

8 With a partner, act out the roles below based on Task 7. Then switch roles.

USE LANGUAGE SUCH AS:

Why ...
There might ...
What holds ...

Student A: You are an electronics instructor. Talk to Student B about:

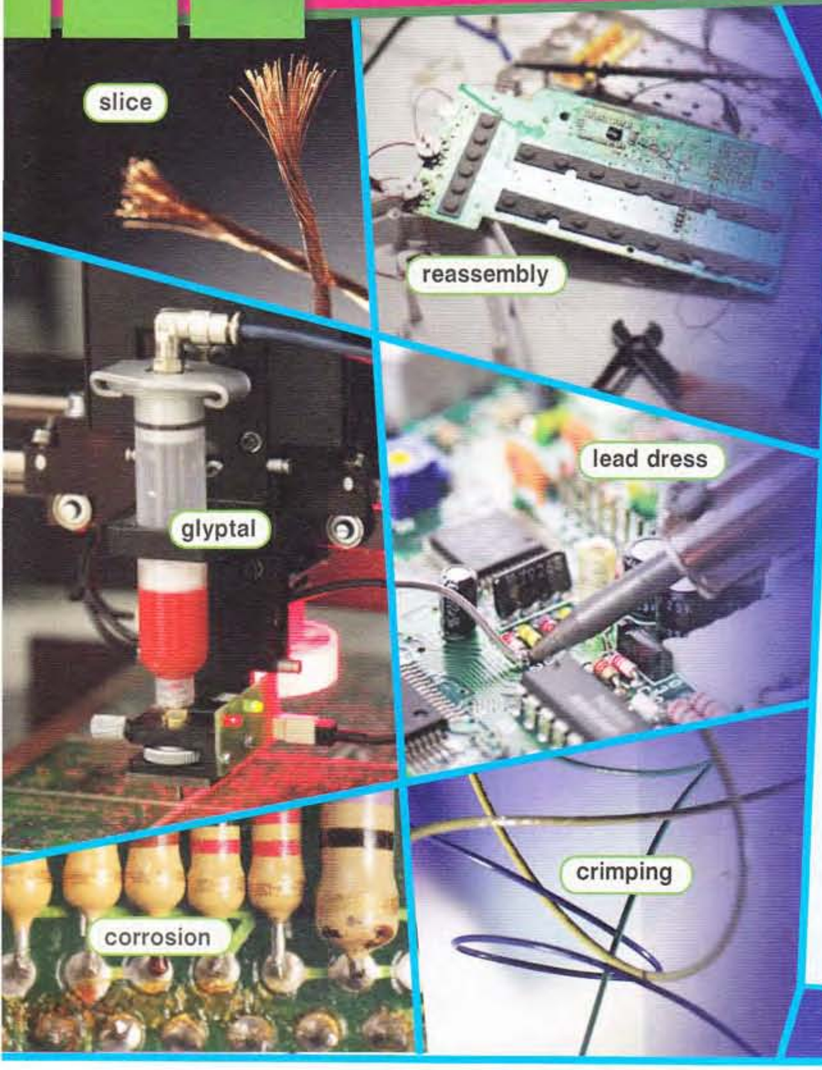
- why layers are needed
- different layers
- what holds them together

Student B: You are a student. Talk to Student A about layers in an electronics device.

Writing

9 Use the textbook excerpt and the conversation from Task 8 to fill out a tip sheet for technicians. Include what layers an electronic device might have, and what holds them together.

13 Interior reassembly



Interior Reassembly

The best way to go about **reassembly** is to **reverse** the order in which you took it apart. **Inner** circuit boards need to be put back in first if you have **multiple** boards. Make sure you check for any **corrosion** where screws or metal brackets make contact. Corrosion causes bad connections. Once you are sure your contact points are clean, screw in the boards. Make sure the screws are tight, but don't **overtighten** them. This can cause **fractures** in circuit boards. To ensure screws are tight enough, apply **glyptal** to them. Just a little bit **wiped** around the edges of the screw will hold it in place.

During **lead dress**, any wires that were **tacked down** before need to be **secured** again. Use silicone sealer or hot-melt glue for this task. Also, if there were any **blobs** of wax that covered transformers or capacitors they should be reattached. It is best to remelt and use the wax that is already there whenever possible. Note any potential **crimping** that could occur. Also, be careful with the sharp ends of a board's leads or the edges of the case, as they can **slice** through a wire's insulation. This can result in a short or even cause electric shock.

Get ready!

1 Before you read the passage, talk about these questions.

1 When are wires reattached to a circuit board?

2 What can happen if water comes into contact with a circuit board?

Reading

2 Read the online article. Then, complete the table.

Item	To Do
Screws	
Wires	
Wax	

Vocabulary

3 Read the sentence and choose the correct word.

1 The tech took care of the **crimping / reassembly** by bending the wires.

2 The tech preferred to use hot-melt glue to **reverse / secure** the wires.

3 The woman did not want to **slice / fracture** the board so she was careful with the screws.

4 The man accidentally **sliced / secured** the wire on the sharp ends of the board's leads.

5 The tech applied **lead dress / glyptal** to the screw, in order to tighten it.

6 During reassembly, the tech planned to **fracture / reverse** the order in which he took the device apart.

7 The woman found **reassembly / glyptal** much more challenging than taking the device apart.

8 The new worker learned how to do **lead dress / crimping**, by watching the experienced tech secure the wires.

4 Fill in the blanks with the correct words and phrases from the word bank.

Word BANK

blob corrosion inner multiple overtightened tacked down wiped

1 The ___________ components were located in the center of the device.
2 The man ___________ the screw and damaged it.
3 The tech melted down the ___________ of wax so that she could use it again.
4 The tech checked the metal contacts for ___________.
5 The woman ___________ the wire with a silicon sealer.
6 ___________ screws were needed to reattach the three boards.
7 The tech ___________ glyptal onto the edges of the screw.

5 Listen and read the online article again. Why is corrosion bad for electronic devices?

Listening

6 Listen to a conversation between two electronics techs. Mark the following statements as true (T) or false (F).

1 __ The man is concerned that he has overtightened the screws.
2 __ Nail polish can be used as a substitute for glyptal.
3 __ Glyptal should not come into contact with the components.

7 Listen again and complete the conversation.

Electronics Tech 1:	Hey, Robin. Can you **1** ______ ______ ______ for a minute? I'm trying to reassemble this radio.
Electronics Tech 2:	Sure, what do you need?
Electronics Tech 1:	Well, I'm worried that the screws on the **2** ______ ______ aren't tight enough.
Electronics Tech 2:	Let me see ... I think we have some **3** ______ in the workshop somewhere.
Electronics Tech 1:	Glyptal? What's that? I've never heard of it.
Electronics Tech 2:	It's a **4** ______ ______ ______ that we use to keep the screws nice and tight. And if you don't have any glyptal handy, you can use nail polish instead.
Electronics Tech 1:	Wow! Really? I never would have **5** ______ ______ ______.
Electronics Tech 2:	Ah, there's the glyptal. **6** ______ ______ ______.

Speaking

8 With a partner, act out the roles below based on Task 7. Then switch roles.

USE LANGUAGE SUCH AS:

What do you need ... / Remember to ...

Be careful not to ...

Student A: You are an electronics tech. Talk to Student B about:

- lead dress
- possible dangers
- protecting components

Student B: You are an electronics tech. Talk to Student A about the reassembly.

Writing

9 Use the online article and the conversation from Task 8 to fill out the tech's notes about reassembly. Include information on lead dress, protecting components, and possible dangers.

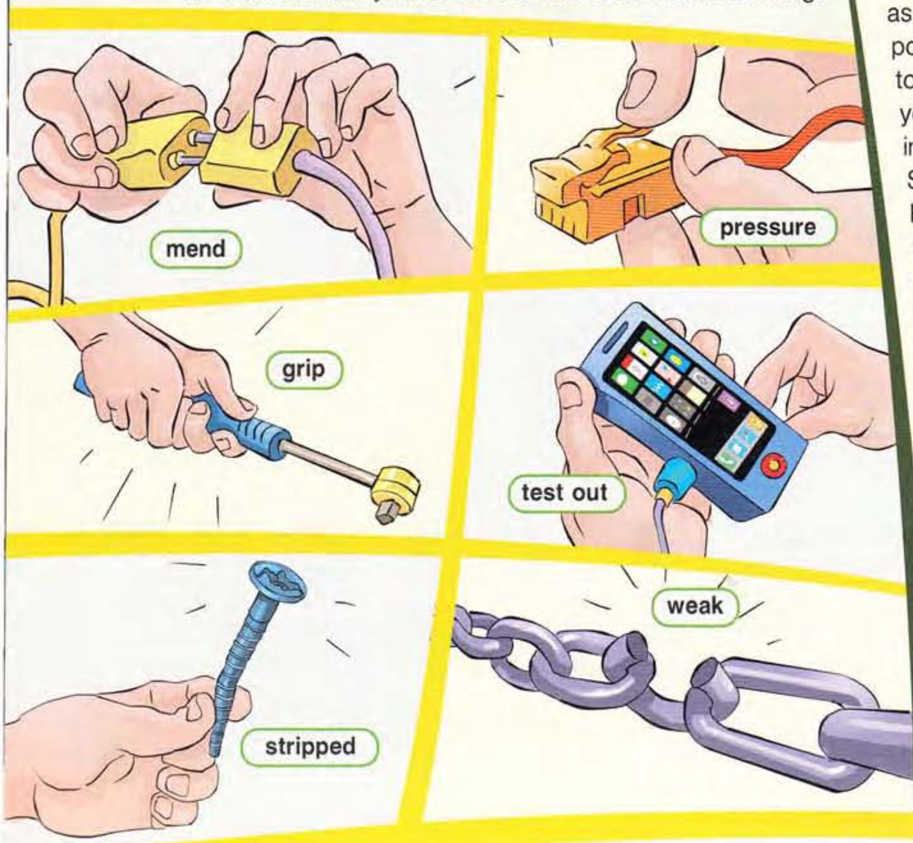
14 Exterior reassembly

Get ready!

1 Before you read the passage, talk about these questions.

1 What must a tech do with broken parts?

2 What should you do to check if a device is working?



Exterior Reassembly

The inside looks good, so it's time to close up that device you've been repairing. Most electronics nowadays have snaps that help hold the parts of a case together. By checking the **style** of the snaps, you can tell how they fit together. **Line up** the snaps on the case as carefully as you can. Then put **pressure** on them. Ideally, they'll pop into place and the edges of the case will fit together tightly. If you see a **noticeable bulge**, recheck your snaps. One might not be securely fastened. Keep in mind that snaps are known for being **weak**. Sometimes one or two broken snaps are no big deal. However, sometimes broken snaps can make a case **wobbly**. You can use a plastic melting iron to **mend** the snaps, but they won't be as **sturdy** as before.

Screws often also hold a case together. Be careful when reinstalling screws or else you can damage them. Plastic cases can also be cracked by installing screws incorrectly. A **stripped** screw is very hard to remove later on when you need to open the case again. Insert the screws into the case, but don't tighten them yet. Make sure all the screws are in the right place and that you don't need to open the case again. **Grip** the screwdriver with your fingers and just turn the screws until they stop. You want them to be **snug**, but don't twist them in until they won't move anymore.

Now you're ready to **test out** your repaired electronic device.

Reading

2 Read the trade magazine article. Then, choose the correct answers.

1 What is the purpose of the article?

- A to explain how to repair snaps
- B to advertise snaps and screws
- C to describe how to close cases
- D to define exterior reassembly

2 Which is NOT a potential reassembly problem?

- A a cracked case
- C a stripped screw
- B a lined up snap
- D a wobbly case

3 How do you install a screw?

- A Turn the screw until you meet resistance.
- B Align the screw and pop it into place.
- C Use a plastic melting iron.
- D Twist the screw until it won't turn anymore.

Vocabulary

3 Match the words (1-8) with the definitions (A-H).

1 __ bulge

2 __ line up

3 __ mend

4 __ pressure

5 __ stripped

6 __ style

7 __ test out

8 __ weak

A to fix something so that it can be used again

B being tightened to the point that something will no longer stay in place

C to make one thing even with another

D to see if something works correctly

E an identifiable form of an object

F lacking strength

G a part of an object that swells outward

H the process of applying force to something by pressing on it

4 **Read the sentence pair. Choose where the words best fit the blanks.**

1 **noticeable / sturdy**

A The device was __________ and difficult to break.

B There was a __________ problem with the circuit.

2 **gripped / stripped**

A It was difficult removing the __________ screw.

B The tech __________ the screwdriver and tightened the screw.

3 **wobbly / snug**

A The case was __________ because it had a broken snap.

B The screw wasn't unstable, it was __________.

5 **Listen and read the trade magazine article again. What happens when a snap breaks?**

Listening

6 **Listen to a conversation between an electronics tech and a customer. Mark the following statements as true (T) or false (F).**

1 __ There is a large gap in the DVD player's case.

2 __ The woman will use a plastic melting iron to repair the DVD player.

3 __ The DVD player will be as good as new.

7 **Listen again and complete the conversation.**

Electronics Tech:	Good morning, How can I help you today?
Customer:	I need some help with this DVD player. The **1** ______ ______ ______.
Electronics Tech:	How loose is it?
Customer:	Well, the gap between the two halves is **2** ______ ______ that you can see the wires inside.
Electronics Tech:	That's not good. Let me **3** ______ ______ ______ at it. Hmm ...
Customer:	What do you think?
Electronics Tech:	It looks like some of the **4** ______ ______ ______. It's making the case wobbly. I think I can also hear pieces of the broken snaps rattling around in the device.
Customer:	Can you fix it?
Electronics Tech:	Yes, I can **5** ______ the snaps with a plastic melting iron.
Customer:	Great!
Electronics Tech:	But I need to tell you that the repaired snaps aren't **6** ______ ______.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then switch roles.**

USE LANGUAGE SUCH AS:

Is it easy to ... / What happens if ...

Insert the ...

Student A: You are an electronics tech. Talk to Student B about:

- a camera
- the problem
- the repair

Student B: You are a customer. Talk to Student A about a camera that needs to be repaired.

Writing

9 **Use the trade magazine article and the conversation from Task 8 to create a work order. Include the type of item being repaired, the problem with the item, and how the problem will be resolved.**

15 Disposal of electronics

An E-Wasteland

By Jim O'Dell

Electronic waste, or e-waste, is a rapidly growing problem. New electronic devices come on the market faster than ever before. Sometimes electronics break or just wear out. So what happens to all the old electronics people don't have a use for anymore?

Often they just get thrown out in the trash and end up in **landfills**. The problem with this is that electronics often contain **toxic** materials. These materials can **leech** into the ground and water supplies. Contaminated soil and water can cause **harmful** health effects for people, animals, and plants. Electronic devices should never just be thrown out with everyday garbage. They need to be treated as **hazardous waste** and **disposed of** properly. Many places have begun programs so people can get rid of their unwanted electronics. If the device is not very old and has only minor defects it can be **refurbished**. **Obsolete** items that are in good working condition can be **donated**. Many non-profit organizations especially welcome donated mobile phones and computers. Some **retailers** offer **collection programs** where customers can bring their old electronics. People can also bring their old electronics in to be **recycled**. Devices are **broken down** and all the parts that can be reused are removed. The unusable parts are then safely disposed of.

However you decide to get rid of your unwanted electronics, keep one very important thing in mind: Always make sure you erase all of your **personal data** from any electronic device before disposing of it.

Get ready!

1 Before you read the passage, talk about these questions.

1 Why is it important to dispose of electronic waste properly?

2 What are some things that can happen to electronic waste?

Reading

2 Read the newspaper article. Then, mark the following statements as true (T) or false (F).

1 __ The proper way to dispose of electronic waste is at a landfill.

2 __ Electronics can be donated or refurbished.

3 __ You should erase your personal information before getting rid of electronics.

Vocabulary

3 Read the sentence and choose the correct word.

1 Erica did not want to harm the environment, so she disposed of her **personal data / electronic waste** responsibly.

2 The retailer set up a **collection program / hazardous waste** to handle customers' electronic waste.

3 The **obsolete / toxic** chemicals polluted the ground water.

4 The customer turned in a cell phone that was only a year old, so the store decided to **refurbish / leech** it.

5 The computer was fifteen years old and its technology was outdated and **obsolete / toxic**.

6 Jenna was careful to remove her **hazardous waste / personal data** before donating her computer.

7 The toxic materials started to **refurbish / leech** into the ground, polluting the soil.

8 The **collection program / hazardous waste** was toxic and had to be disposed of properly.

4 Write a word that is similar in meaning to the underlined part.

1 The trash was dumped in a place specifically designed for waste storage. _ _ n _ f _ l _
2 Some of the computer parts were plastic so they could be used again. _ e _ y _ l _ d
3 Ben gave away his computer to a school that needed it. _ o n _ _ e d
4 The students learned how to get rid of electronic waste _ _ s _ o _ e _ _
5 Toxic chemicals are damaging to the environment. _ _ r _ f _ l
6 During recycling, devices are taken apart and the reusable components are removed. b _ _ k e _ _ o _ n
7 A row of businesses selling items to customers lined the street. _ e _ a _ _ e _ s

5 Listen and read the newspaper article again. Why is electronic waste such a growing problem?

Listening

6 Listen to a conversation between an electronics tech and a customer. Choose the correct answers.

1 What is the conversation mostly about?
A ways to repair electronics
B the company's new collection program
C problems that landfills cause
D how to dispose of a damaged computer

2 What does the tech suggest?
A donating the device
B refurbishing the device
C paying for a repair
D changing the power source

7 Listen again and complete the conversation.

Electronics Tech:	Shockwave Electronics. How can I help you?
Customer:	Hi, I want to **1** ______ ______ ______ a computer, but I'm not sure how to do it.
Electronics Tech:	Does the computer still work?
Customer:	No, there was a **2** ______ ______ during a lightning storm. I think it fried the computer.
Electronics Tech:	But nobody looked at it to see if **3** ______ ______ ______ ______?
Customer:	Well, it's kind of old, so I didn't want to **4** ______ ______ ______. I just ended up buying a new one.
Electronics Tech:	Okay, we have a **5** ______ ______ ______.
Customer:	Great, I'm listening.
Electronics Tech:	First, you can bring it in and I can see if I can get it running again, **6** ______ ______ ______ to you.

Speaking

8 With a partner, act out the roles below based on Task 7. Then switch roles.

USE LANGUAGE SUCH AS:

Is the phone still ... / You have a few ...

We dispose ...

Student A: You are an electronics tech. Talk to Student B about:
- disposing of the phone
- collection programs
- personal data

Student B: You are a customer. Talk to Student A about ways to dispose of a phone.

Writing

9 Use the newspaper article and the conversation from Task 8 to create a brochure on electronic waste disposal. Include what can be done with working electronics, non-functional electronics, the disposal of parts that cannot be recycled, and personal data.

Glossary

active heat sink [N-COUNT-U9] An **active heat sink** is a heat sink that is connected to a case fan, located right above the heat sink, in order to help cool the processor.

adhesive [N-COUNT/UNCOUNT-U3] An **adhesive** is a glue which keeps two things stuck together.

airflow [N-UNCOUNT-U9] **Airflow** is the movement of air, particularly around or through something.

aluminum [N-UNCOUNT-U9] **Aluminum** is a lightweight, silver-colored metal that can be used to make heat sinks.

amplification [N-UNCOUNT-U7] **Amplification** is increasing the power of a signal by use of an external energy source.

antenna [N-COUNT-U7] An **antenna** is a wire or a metal pole that is used to get or send signals.

application [N-COUNT-U5] An **application** is a purpose for which something is used.

attachment [N-COUNT-U9] An **attachment** is an object that is connected to another object, such as a machine, in order to make it do a specific job.

audio [N-UNCOUNT-U7] **Audio** is sound, particularly music, that is recorded, broadcast, or played using an electronic device.

battery compartment [N-COUNT-U12] A **battery compartment** is the section of an electronic device in which a battery is placed.

blob [N-COUNT-U13] A **blob** is a small drop or soft lump of something.

block diagram [N-COUNT-U1] A **block diagram** is a basic diagram that uses rectangles or blocks to show functions or connections.

break down [PHRASAL V-U15] To **break down** something is to take it apart.

build up [PHRASAL V-U5] To **build up** is to gradually collect something.

bulge [N-COUNT-U14] A **bulge** is a part of an object that swells or curves outward.

cable [N-COUNT-U7] A **cable** is a wire covered with a plastic coating. It is used to carry signals.

call number [N-COUNT-U2] A **call number** is a combination of letters and numbers that tells technicians what a part is and where it is located in a device.

case [N-COUNT-U3] A **case** is the outside of a device. It covers the circuits.

case fan [N-COUNT-U9] A **case fan** is a type of fan that takes cool air from outside and blows it through a computer, sending hot air out of the rear.

chassis [N-COUNT-U1] The **chassis** is the frame of an electrical device.

chop off [PHRASAL V-U4] To **chop** something **off** is to remove it by cutting it.

circuit board [N-COUNT-U12] A **circuit board** is a flat panel in an electronic device that contains microchips or connections.

clear [V-T-U4] To **clear** something is to remove obstacles which block a passage.

clip [V-T-U4] If you **clip** something, you cut it carefully.

coating [N-COUNT-U4] A **coating** is a thin layer.

collect [V-T-U7] To **collect** a signal is to receive it.

collection program [N-COUNT-U15] A **collection program** is when items are brought to a certain location by people so they can be gathered up and reused or disposed of.

combine [V-I-U8] To **combine** is to put two different things together.

come off [PHRASAL V-U3] To make something **come off** means you separate it from something else.

complex [ADJ-U11] If something is **complex**, it is complicated and not simple.

composite [N-UNCOUNT-U7] **Composite** is a kind of baseband video, where the whole signal is carried on one wire.

conceptual [ADJ-U1] If something is **conceptual**, it uses ideas or theories.

congregate [V-I-U6] To **congregate** is to gather together.

connect [V-T-U7] To **connect** is to link two different things together.

consider [V-T-U5] To **consider** something, is to think about it.

convert [V-T-U8] To **convert** is to change something into something different.

cool down [PHRASAL V-U9] To **cool down** is to become colder or to cause something to grow colder.

copper [N-UNCOUNT-U9] **Copper** is a soft reddish brown metal that is a good conductor of heat and electricity.

corrosion [N-UNCOUNT-U13] **Corrosion** is a process where metal is destroyed by a chemical reaction, such as rust.

counterclockwise [ADJ-U12] If you turn an object **counterclockwise**, you turn it from right to left.

crimping [N-UNCOUNT-U13] **Crimping** is when a wire becomes bent or folded.

crooked [ADJ-U11] If something is **crooked**, it is not straight.

custom made [ADJ-U11] If an object is **custom made**, it is designed for a specific purpose.

deform [V-T-U4] To **deform** something is to change its shape.

delaminate [V-T-U4] To **delaminate** something is to remove its coating.

delicate [ADJ-U11] If an object is **delicate**, it is fragile or weak.

designation [N-COUNT-U2] A **designation** is an alternate name or title for something.

diagram [N-COUNT-U1] A **diagram** is a drawing that explains how something works.

disassemble [V-T-U3] To **disassemble** something means to take it apart.

disconnect [V-T-U3] To **disconnect** an electronic device means you remove it from the power supply.

display [N-COUNT-U7] A **display** is a visual presentation of information.

dispose of [PHRASAL V-U15] To **dispose** of something is to get rid of it because it is no longer wanted or needed.

donate [V-T-U15] To **donate** something is to give it away for free to someone else who has use for it.

double-check [V-I or T-U4] To **double-check** something is to check it again after already checking once.

draw away [PHRASAL V-U9] To **draw away** is to move further from a person or place.

drawing [N-COUNT-U1] A **drawing** is a representation of an object.

drawing paper [N-UNCOUNT-U12] A piece of **drawing paper** is a piece of paper on which to draw or sketch diagrams or designs.

electronic waste [N-UNCOUNT-U15] **Electronic waste** is electronic devices that people no longer use and want to dispose of.

far away [ADJ-U2] If an object is **far away**, it is not close.

feed [V-T-U7] To **feed** is to supply something to a person or object.

figure out [V-T-U10] To **figure out** something is to understand or solve it.

filter [N-COUNT-U6] A **filter** is a device that lets some things pass through, while blocking others.

fixed [ADJ-U12] If an object is **fixed**, it is set in place and will not move.

flip-up latch [N-COUNT-U11] A **flip-up latch** is a latch that can be opened by lifting up two tabs.

flow [V-T-U4] When a liquid or gas **flows**, it moves in a steady, continuous stream.

force [V-T-U3] To **force** something means to try to make it do something when it is resistant.

fracture [V-T-U13] To **fracture** something is to cause it to crack or break.

gap [N-COUNT-U10] A **gap** is an opening in a solid structure.

give [V-I-U10] If a material **gives**, it bends with elasticity.

glyptal [N-UNCOUNT-U13] **Glyptal** is an adhesive substance that is used to hold objects in place.

Glossary

grip [V-T-U14] To **grip** something is to hold it firmly in your hand.

half [N-COUNT-U10] A **half** is one of two equal parts of something.

hard switch [N-COUNT-U6] A **hard switch** is a switch that must cut off the load current in a certain amount of time, while coping with high voltage and current.

harmful [ADJ-U15] If something is **harmful**, it has the ability to hurt living things or the environment.

hazardous waste [N-UNCOUNT-U15] **Hazardous waste** is unwanted products that may be harmful to living things or the environment if not disposed of correctly.

heat sink [N-COUNT-U9] A **heat sink** is a device that removes heat from another object. It is used to cool down a computer's processor and stop it from overheating.

heat-sinking [ADJ-U4] If something produces a **heat-sinking** effect, it cools quickly.

hidden [ADJ-U3] If something is **hidden**, it can't easily be seen.

identifier [N-COUNT-U2] An **identifier** is something that identifies an object.

indentation [N-COUNT-U3] An **indentation** is the place where a flat surface suddenly falls inwards.

inductor [N-COUNT-U6] An **inductor** is a two-terminal electrical component that stores energy in its magnetic field.

industry standard [N-COUNT-U12] An **industry standard** is a level or norm that an industry (such as the electronics industry) sets and that all pieces of equipment must meet.

inner [ADJ-U13] If an object is **inner**, it is inside or towards the center of something.

input [N-UNCOUNT-U7] **Input** is anything that enters a system.

input jack [N-COUNT-U7] An **input jack** receives audio signals and allows people to hear these sounds.

label [V-T-U2] To **label** is to mark or identify something so that it is clear what the thing is.

landfill [N-COUNT-U15] A **landfill** is a place specifically designed to store waste.

latch [N-COUNT-U11] A **latch** is a bolt or catch that fastens two things together.

lay out [PHRASAL V-U1] To **lay out** items is to design or arrange them.

layer [N-COUNT-U12] A **layer** is a piece of material which protects something or which is between other pieces of material.

lead dress [N-UNCOUNT-U13] **Lead dress** is the process of placing and securing wires in an electronic device.

leech [V-I-U15] To **leech** is to drain off into the ground.

linear power supply [N-COUNT-U6] A **linear power supply** is a type of electronic power supply that uses a linear regulator in order to set the voltage and protect the power supply. A linear regulator is a variable resistor.

line up [V PHRASE-U14] To **line up** something is to make it even with something else.

look up [PHRASAL V-U2] To **look up** is to search for information about something.

lose track [PHRASAL V-U12] To **lose track** of something is to no longer know where an object is.

mail-order [ADJ-U5] If something is **mail-ordered**, it is delivered through the mail.

melt [V-T-U10] To **melt** a substance is to turn it into a liquid using heat.

mend [V-T-U14] To **mend** something is to fix it so it can be used again.

metal shield [N-COUNT-U12] A **metal shield** is a strip of metal that is placed on top of an object to protect it.

method [N-COUNT-U2] A **method** is a way or process of doing something.

microprocessor [N-COUNT-U6] A **microprocessor** is an electronic device inside a computer that allows it to work. It can also be called a processor.

molten [ADJ-U4] **Molten** metal has been made into liquid by being heated to a very high temperature.

multi-layered [ADJ-U4] If something is **multi-layered**, it has many parts on top of each other.

multiple [ADJ-U13] **Multiple** means many or involving many things.

multi-section [ADJ-U2] If an object is **multi-section**, it is made of more than one part or section.

navigate [V-I-U1] To **navigate** is to deal with or understand something complicated.

necessary [ADJ-U10] If something is **necessary**, it is absolutely required.

noticeable [ADJ-U14] If something is **noticeable**, it is easy to see it.

nut [N-COUNT-U12] A **nut** is a metal ring or hexagon that a screw fits into.

obsolete [ADJ-U15] If something is **obsolete**, it has been replaced with a newer model or it is no longer being used.

output [N-UNCOUNT-U7] **Output** is anything that a system produces.

overall [ADJ-U1] The **overall** of something is the total or complete part of it.

overheat [V-T or I-U9] To **overheat** is to grow too hot or to cause something to grow too hot. Overheating often damages the object that becomes too hot.

overtighten [V-T-U13] To **overtighten** is to turn a screw until it may cause damage to the screw or a product.

oxidation [N-UNCOUNT-U5] **Oxidation** is the process in which oxygen combines with a substance. It causes rust.

panel [N-COUNT-U3] A **panel** is a plastic cover. It covers parts of a machine, for example the place where you keep batteries.

parallel [ADJ-U11] If two lines run **parallel** to each other, they extend in the same direction, equidistant to each other.

parameters [N-COUNT PLURAL-U8] **Parameters** are a set of limits that control the way that something should be done.

passive heat sink [N-COUNT-U9] A **passive heat sink** is a heat sink that has just one fan, inside the computer, to send air across the heat sink and out of the computer.

patience [N-UNCOUNT-U3] **Patience** is a personal quality. If a person has patience, they stay calm when things don't happen quickly.

permanent marker [N-COUNT-U11] A **permanent marker** is a writing instrument with ink that does not fade and cannot easily be erased.

personal data [N-UNCOUNT-U15] **Personal data** is specific information about a person that can be stored on electronic devices.

pictorial diagram [N-COUNT-U1] A **pictorial diagram** shows the parts of an object and how they connect.

placement [N-UNCOUNT-U1] The **placement** of an object is the specific place where it is put.

play back [PHRASAL V-U8] To **play back** something is to listen to or watch a message or video that has already been recorded.

pop [V-T-U10] To **pop** something is to open or release it by applying pressure to it.

power supply [N-COUNT-U6] A **power supply** is a device that provides electrical energy to at least one electric load. An example of a power supply is a battery.

precisely [ADV-U12] If you do something **precisely**, you do it very correctly or accurately.

pressure [N-UNCOUNT-U14] **Pressure** is the process of applying force to something by pressing on it.

process [V-T-U8] To **process** information is to use electronic equipment in order to organize it.

pry [V-T-U10] To **pry** something open is to force it open.

reassembly [N-UNCOUNT-U13] **Reassembly** is the process of putting something back together again.

record [V-T-U8] To **record** is to store sounds or images, so that they can be listened to or watched again.

recycle [V-T-U15] To **recycle** waste is to process it so it can be reused again.

refurbish [V-T-U15] To **refurbish** something is to improve it by installing new parts or cleaning it up.

regulation system [N-COUNT-U6] A **regulation system** is a system's ability to make sure that voltage is constant, or near constant.

reinforced [ADJ-U11] If an object is **reinforced**, it is made stronger.

resonate [V-I-U7] To **resonate** is to make a deep, clear noise that lasts for a long time.

retailer [N-COUNT-U15] A **retailer** is a business that sells items to customers.

retrieve [V-T-U8] To **retrieve** information is to access information that is stored, in order to use it again.

reuse [V-T-U5] To **reuse** an item is to use it again, when it has already been used.

reverse [V-T-U13] To **reverse** a process is to do the opposite of what was done before.

ribbon cable [N-COUNT-U11] A **ribbon cable** is a broad and flat cable which contains numerous wires side by side.

round [ADJ-U6] If something is **round**, it is in the shape of a circle or a sphere.

schematic diagram [N-COUNT-U1] A **schematic diagram** shows the detailed parts of an item but not the function.

sealed [ADJ-U3] If something is **sealed**, it has been closed securely.

seam [N-COUNT-U10] The **seam** is the line where two pieces of material meet.

section [N-COUNT-U1] A **section** is a specific portion or part of something.

secure [V-T-U13] To **secure** something is to firmly affix it in position so it will not come loose.

send [V-T-U8] To **send** is to cause a message or signal to go somewhere.

service manual [N-COUNT-U1] A **service manual** is a book of instructions that usually comes with an electronic device.

similar [ADJ-U5] If two components are **similar**, they are very much alike.

slice [V-T-U13] To **slice** something is to cut through it.

slide latch [N-COUNT-U11] A **slide latch** is a latch that can be opened by pulling two tabs.

slot [N-COUNT-U10] A **slot** is a narrow opening where something is to be inserted.

smack [V-T-U3] To **smack** something is to hit it hard.

small-scale [ADJ-U8] If something is **small-scale**, it is not as big as other similar objects.

snap [N-COUNT-U3/10] A **snap** is a mechanical clip that keeps two parts of an object together.

snug [ADJ-U14] If something is **snug**, it is close-fitting.

socket [N-COUNT-U11] A **socket** is an empty space that an object fits or plugs into.

specify [V-T-U1] To **specify** something is to clearly state a detail.

speed [N-COUNT/UNCOUNT-U9] **Speed** is the rate at which a person or object travels or moves.

square [ADJ-U6] If something is **square**, it is made up of four straight lines that are the same length. These lines meet to form corners, known as right angles.

stack [V-T-U12] To **stack** something is to put one object on top of another.

standardize [V-T-U2] To **standardize** is to make an object match or be on the same level as a particular standard.

standardized [ADJ-U5] If a component is **standardized**, how it - and all other duplicate components - is built and used never changes.

stockpile [N-COUNT-U5] A **stockpile** is an accumulation of certain items.

stripped [ADJ-U14] If a screw is **stripped**, it means it has been tightened to the point where it will no longer stay in place properly.

stuck [ADJ-U3] If something is **stuck**, it won't move or open.

sturdy [ADJ-U14] If something is **sturdy**, it is solid or strong.

style [N-COUNT-U14] A **style** is an identifiable form of an object.

substitute [V-T-U5] To **substitute** an object is to replace an object with a different object.

suck [V-T-U4] To **suck** something is to remove it using a vacuum.

switching supply [N-COUNT-U6] A **switching supply** is a type of electronic power supply that uses a switching regulator to move back and forth from the "off" to "on" position. This reduces wasted energy and regulates output voltage. A switching regulator is a switch.

synthesize [V-T-U8] To **synthesize** sound is to use electronics in order to make sounds, music or speech.

tab [N-COUNT-U11] A **tab** is small strip of material on an object, which is pulled to open something.

tack down [PHRASAL V-U13] To **tack down** something is to secure it to another object using an adhesive.

take in [PHRASAL V-U8] To **take in** something is to receive something, such as information.

test out [PHRASAL V] To **test out** something is to see if it works properly.

thermal absorption [N-UNCOUNT-U4] **Thermal absorption** is when heat is taken up by something.

thermal conductor [N-COUNT-U9] A **thermal conductor** is a device used to move heat away from a computer's central processing unit.

toroid [ADJ-U6] If something is **toroid** shaped, it is in the shape of a ring and has a circular hole in the center.

toxic [ADJ-U15] If something is **toxic**, it contains poisonous substances.

transducer [N-COUNT-U7] A **transducer** is a device that receives power from one source then alters that power so that another system can use it.

tuning [N-UNCOUNT-U8] **Tuning** is the act of setting a radio or television to receive a specific program or station.

unhook [V-T-U10] To **unhook** something is to unfasten it.

unique [ADJ-U2] If something is **unique**, it is one of a kind.

unrelated [ADJ-U2] If something is **unrelated** to something else, it is not connected or related to that thing.

varactor [N-COUNT-U7] A **varactor** is a voltage-variable capacitor that helps to control tuning.

visible [ADJ-U10] If something is **visible**, it is able to be seen by the naked eye.

voltage inverter [N-COUNT-U6] A **voltage inverter** is a special kind of power supply that takes low voltage and turns it into high voltage. A voltage inverter is like a small switching supply.

weak [ADJ-U14] If something is **weak**, it is not strong or sturdy.

wipe [V-T-U13] To **wipe** is to rub something on an object with light strokes.

wobbly [ADJ-U14] If something is **wobbly**, it is not stable and moves or shakes when pressure is applied.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